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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

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28 PROPELLANTS AND FUELS 1012
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
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Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

74 OPTICS 1088
Includes light phenomena.

75 PLASMA PHYSICS 1089
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 1095
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1098
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) 1098
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1098
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1099
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 1100
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1101
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1101
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 1105

89 ASTRONOMY 1105
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1105
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1106
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1106
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1107
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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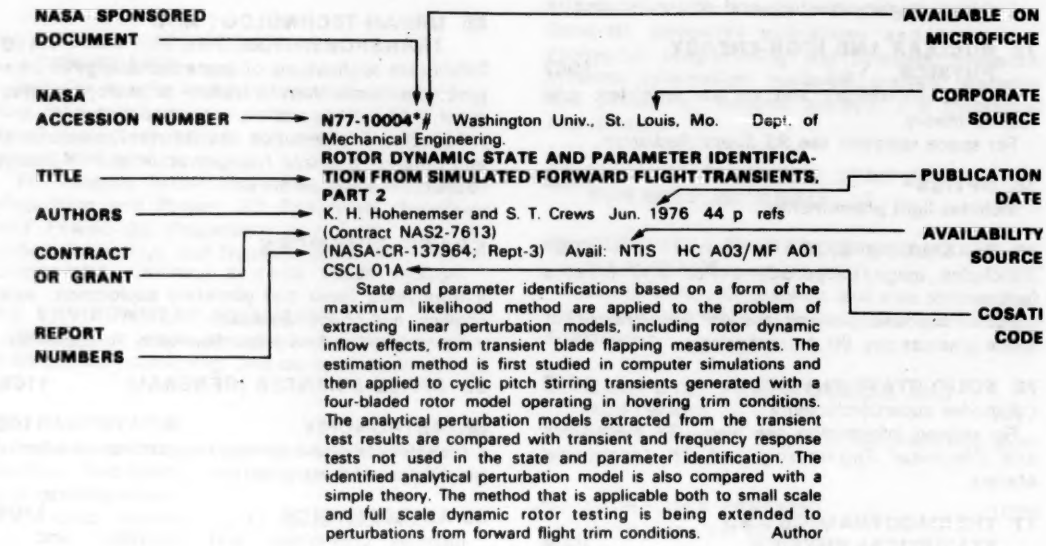
REPORT/ACCESSION NUMBER INDEX I-81

TYPICAL CITATION AND ABSTRACT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N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs
(Contract NAS2-7613)
(NASA-CR-137964; Rept-3) Avail: NTIS HC A03/MF A01
CSCL 01A
State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, COMPARISON OF MILITARY AND COMMERCIAL DESIGN-TO-COST AIRCRAFT PROCUREMENT AND OPERATIONAL SUPPORT PRACTICES
L. CARLYLE, McDonnell Douglas Corporation, *Long Beach, California* 90808 (DF135610; F33615-75-C-3139)

HQ AFSC/AV directed this effort in support of project ACE as a parallel study to that presently being conducted by Boeing Aerospace Company, Contract F33615-74-3100, same title. Experience dictates that comparison of the commercial approach to design-to-cost management of an aircraft program with that employed by the DoD will yield many proven techniques and practices which can be directly applied to military weapon system procurement. Overall objective of this study will be to determine those aspects of commercial aircraft procurement and operational support which, if applied to the DoD environment, would result in significant reductions in the unit flyaway and life cycle support costs of future USAF aircraft.

A program will be implemented to examine, analyze and conduct a comparative evaluation of all phases of the system life cycle, i.e., planning, design, development, manufacturing/production, test and evaluation, and operations and logistic support of selected military and commercial aircraft programs. This will be accomplished to identify those differences in techniques and practices which result in lower acquisition and support costs for commercial aircraft, and conversely, higher costs for military aircraft. Analyses and evaluations derived will be used to develop recommendations regarding the feasibility and practicality of applying high-payoff commercial practices to military aircraft programs to achieve reduced costs.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXCB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0002, ENHANCED INTERACTIVE GRAPHICS STRUCTURAL COST MODEL
B.H. OMAN, General Dynamics Corporation, *San Diego, California* 92112 (DF136900; F33615-76-C-3080)

The Air Force, in order to maintain air superiority, must obtain advanced aerospace vehicles and modify existing systems. Reliable cost and weight analysis is required if these systems are to have the minimum cost for the acceptable level of performance. The objective of this task is to provide an integrated analysis model using interactive graphics computer program so that accurate cost and weight assessments may be made in a short time.

This effort will extend the capabilities and improve the efficiency of the cost and weight interactive graphics computer program, delivered to the Air Force under Contract F33615-75-C-0113. The improvements to be made will allow analysis of composite structures, and will make the program efficient by setting up a universal inter-disciplinary data base and by restructuring the program into a modular form. The results of the effort will be documented in a final report which will include a technical report and a user's manual. The upgraded computer program will be installed and checked out on the ASD Cyber 74 computer.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBSA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0003, OPTICAL SYSTEM FOR DYNAMIC ANALYSIS OF ROTATING STRUCTURES
K. STETSON, United Technologies Corp., *Hartford, Connecticut* 06108 (DF457560; F33615-75-C-2013)

The objective of this program is the development and laboratory application of an optical system for performing strain and displacement measurements on rotating structures such as blades and disks. The basis for the optical system is a rotating erector prism which provides continuous motion compensation with respect to the rotating object. Upon development the contractor will use the system to investigate holographic interferometry, speckle photography, and moire interferometry analysis of a rotating blade-disk assembly. The data obtained using these optical techniques will be compared to strain gage results to check both its degree of accuracy and repeatability. Upon demonstrating feasibility and utility of the optical system, a short preliminary study will be carried out to address the problems involved in transitioning the laboratory prototype system to an actual spin pit or test stand optical measurement system.

The overall objective of the program is to develop an optical system for investigating the application of holographic interferometry, speckle photography and moire interferometry for performing dynamic measurements on rotating structures. The program is divided into four phases over a 20-month period including reporting time. Phase I - design study phase, II - erector system development, phase III - applications of systems to rotating objects, and phase IV - problems related to spin pit/engine test stand application.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0004, COMMUNICATIONS - ADAPTIVE TECHNIQUES IN COMMUNICATIONS AND CONTROL THEORY
K.S. NARENDRA, Yale University, School of Engineering, *New Haven, Connecticut* 06520 (DN123505; N00014-76-C-0017)

The Navy has application for self-adaptive control systems in automatic control environments that arise in aircraft control systems, in process control, in filtering of communications channels, and in electronics operating in varying environments.

The work to be performed is concerned with theoretical questions of stability, effects of time-varying environments and the development of rapidly converging algorithms of control by adaptive techniques applicable for non-linear processes. Practical applications to adaptive array processors and adaptive control of aircraft systems will be investigated.

ADDENDA: Supporting agency address is: Office of Naval Research 427, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0005, TIME-DEPENDENT FIRE BEHAVIOR OF AIRCRAFT CABIN MATERIALS
UNKNOWN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20324 (FA59105; FA76WAI-610)

The FAA recently proposed rules for limiting the smoke emissions of aircraft interior materials and is considering standards to control toxic gas emissions. The ultimate goal is a fire-safe aircraft cabin environment considering all aspects of the fire safety problem. The objective is to investigate the time-dependent fire behavior of aircraft cabin materials, with specific regard to their critical mass fuel consumption rate, in order to define a methodology for applying the concept to the problem of ranking cabin materials for their hazardous gaseous products of combustion, i.e., smoke and toxic gases.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0006, FREE-STREAM DATA COLLECTION
V.S. OXFORD, U.S. Air Force, Armament Test Laboratory, *Eglin Air Force Base, Florida* 32542 (DF641560)

Air Force function - aircraft-stores compatibility. Opportunity - structural integrity and certification of stores on aircraft. Goal - to provide store free-stream aerodynamic data in graphical, tabular, and magnetic tape form. How work contributes - allows for a quick and efficient means of obtaining data for use with MIL-A-8591E and for comparisons with stores in carriage.

The approach will be to first compile the existing available store free stream aerodynamic data, and then develop a data retrieval system which allows for access to the data through tabular, graphical, or magnetic tape form. The system will be updated to include new data as it becomes available.

ADDENDA: Supporting agency address is: AF Armament Laboratory DLJC, Eglin AFB, Fla 32542

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0007, JET FLAP DUCT FLOW INVESTIGATION
E.D. THAYER, United Aircraft Corporation, *West Palm Beach, Florida* 33402 (DF138110; F33615-76-C-3108)

Recent Air Force programs have indicated the use of high aspect ratio 2-d nozzles can improve aircraft maneuverability via thrust vectoring/supercirculation effects and reduced wave drag in addition to increasing survivability by reducing infrared signature. A problem encountered with using high aspect ratio 2-d nozzles is minimizing the performance loss resulting from passing the engine exhaust airflow through ducting which transitions from a circular cross section at the turbine exit to a rectangular cross section at the augmentor. The objective of this work is to develop means of accomplishing this airflow transition with a minimum loss of thrust.

The approach is to instrument an existing high aspect ratio 2-d nozzle transition duct rig and conduct tests under simulated engine conditions with various duct airflow mixing and splitting apparatus. The data will be analyzed to identify the effects of aerodynamic and geometric variables on flow uniformity and pressure losses caused by the duct transition.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0008, ADVANCED COOLED TURBINE AIRFOIL AERODYNAMIC INVESTIGATION
P. MITCHELL, United Technologies Corp., *West Palm Beach, Florida* (DF459150; F33615-76-C-2009)

Ategg and development engines all show adverse turbine performance whenever film cooling is employed on the convex side of the airfoil near the trailing edge. Film cooling is employed in this area, though, because no other system could provide the required metal temperature reduction. The objective of this program is to verify the (a) cooling effectiveness and (b) low loss of a vane with non-film cooled convex side.

A reduced-solidity F100 first vane (i.e., 43 percent fewer vanes need) has been tested. Lower or equal losses have been measured for this vane, uncooled, than for a B/M F100 vane. A film-cooled version of this vane showed losses about four times the uncooled losses; the B/M vane increases losses only two times over uncooled losses. Both have convex side film cooling. Two potential designs have been identified for further analysis during the program. Both have the potential to provide sufficient cooling for turbine inlet temperatures about 500 degrees F above operational limits of current engines. The same cooled loss level as the F100 B/M vane is predicted. Both designs rely on fabrication techniques that are not production type at present. Should the cooling effectiveness be verified, follow-on tests could include a rotating stage test in an engine.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0009, NAVY VEHICLE DESIGN AND CONSTRUCTION - AEROELASTIC PHENOMENA IN THIN AIRFOIL CASCADES
S. FLEETER, General Motors Corporation, *Indianapolis, Indiana* 46206 (DN223542; N00014-72-C-0351)

Obtain fundamental experimental data on aeroelastic phenomena in thin airfoil cascades with the objective of developing improved analytical techniques, with increased range of validity, useful in the design and development of compact, lightweight compressor components for advanced engine configurations. This research contributes to increased life and reliability of military aircraft engines with optimum performance by providing better design information for compressor components with minimum weight and volume.

The investigation is aimed at acquisition of experimental data and extension of aeroelastic testing of an isolated trunnoined or double- wedge airfoil in a cascade of cantilevered airfoils at supersonic speeds. Laser holography is used to determine vibrational characteristics at Mach numbers for which there is no aeroelastic data availabile. The data closely approximated conditions occurring in turbofan engines and is useful in correlations with analytical predictions obtained from modeling techniques.

ADDENDA: Supporting agency address is: Office of Naval Research 473, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0010, TURBINE ENGINE HIGH-FLOW COMPRESSOR
P. TRAMM, General Motors Corporation, *Indianapolis, Indiana* 46206 (DF453640; F33615-72-C-1233)

Advance the state-of-the-art in transonic/supersonic, high-throughput flow compressor technology while increasing loading to levels beyond current advance efforts.

Design, fabricate, instrument, assemble and test compressor vehicle. Trade studies will be conducted to establish compressor configuration layout. A distortion-sensitivity test program will also be executed along with preliminary engine design and layout.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0011, RADIO NOISE AND LIGHTNING DAMAGE MECHANISMS
J.L. HECKSCHER, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF256850)

AF function - aerospace safety, survivable communications. Deficiency - the AF need to reduce the vulnerability of aircraft, missiles, and ground installations to lightning damage is not being satisfied with present technology. There is no ability at present to receive ELF communications on board aircraft in flight. Objective - provide adequate warning of impending lightning. Estimate missile vulnerability to lightning. Receive ELF on board aircraft. How research contributes - reduces manpower losses and injuries, damage to equipment; devises realistic procedures to follow with regard to missile launches, aircraft flights, and fueling operations; enhances survivability of aircraft communications.

A novel technique 'electrograph' is being evaluated for electrification warning. The electrograph detects and displays weak pulses of vhf, uhf radiating from clouds prior to the occurrence of

lightning. A special lightning radar to track and report electrical activity in storms is being developed. By using long wavelengths it should be possible to observe and locate individual lightning flashes as distinct from rain echoes. To evaluate the hazards to missile launches, the effective conducting lengths of rocket plumes are being measured, and methods are being developed for injecting, and observing the effects of, long metallized filaments in thunderstorms.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LI, L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0012, FLIGHT PERFORMANCE OF GLIDING DECELERATOR SYSTEMS

T.F. GOODRICK, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0G4226)

To analyze the factors necessary to achieve satisfactory flight performance of gliding decelerator systems used to airdrop troops and supplies under exceptional circumstances.

Various analytical techniques and some experimentation will be used to study the various aspects of gliding flight with flexible decelerators and the interrelations of the various aspects. In addition to steady flight characteristics, unsteady flight characteristics such as transition from opening to guided gliding path, response to control actuation, response to wind perturbation and performance of transient landing maneuvers will be studied.

ADDENDA: Supporting agency address is: NARADCOM Natick Development Center, Natick MA 01760

SUPPORTED BY U.S. Dept. of Defense - Army

1.0013, HIGH-SPEED INLET INVESTIGATION

D.E. SPONG, McDonnell Douglas Astro. Corp., *St. Louis, Missouri* 63166 (DF133970; F33615-75-C-3072)

There currently exists a lack of technology directly applicable to the design and development of advanced air-breathing propulsion systems being considered for advanced high-speed manned aircraft systems. For this class of vehicles, the propulsion system becomes a significant portion of the overall aircraft design and must be considered in the initial stages of the development. The inlet performance can have significant effects on the aircraft range or performance, and if not handled properly the inlet flows could adversely impact the vehicle stability. Proper understanding of the aerodynamic design is required before structural problems can be addressed. The objective of this effort is to develop design criteria and procedures for air induction systems designed for operation in the Mach 3 to 5 speed range.

The approach will be to design inlet systems for both an advanced aircraft system and for an advanced high-speed research system. Following the design and analysis, an experimental program will be conducted to validate or develop the design criteria.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0014, DIGITAL DATCOM EXTENSION PROGRAM OF AIRCRAFT STABILITY AND CONTROL

J.E. WILLIAMS, McDonnell Douglas Astro. Corp., *St. Louis, Missouri* 63166 (DF134480; F33615-75-C-3043)

Rapid and inexpensive methods for predicting the aerodynamic stability and control characteristics of Air Force weapon systems are needed. The availability of these methods will lead to better aircraft designs by permitting rational trade-offs to be considered early in the design. The objective of this work unit is to extend the capability which now exists in the USAF stability and control digital datcom by (1) permitting the program to accept a greater variety of configuration types and (2) extending the range of flight conditions at which predictions are possible and (3) reducing analysis time by simplifying input.

Digital datcom now requires, as input, the 2-dimensional aerodynamic characteristics of the airfoil sections of each lifting surface. Automated prediction of these characteristics will be incorporated into the program. The experimental data substitution option of the program now permits substitution of experimental characteristics for which datcom predictions are available. Therefore, experimental data can now be used to improve accuracy but not to extend the applicability of the methods. Methods will be programmed which will use empirical characteristics (for which prediction methods do not exist) as a base to provide predictions over an expanded range of flight conditions and configuration types.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0015, EXPERIMENTAL EVALUATION OF NON-AXISYMMETRIC EXHAUST NOZZLES

P.E. HILEY, McDonnell Douglas Corporation, *St. Louis, Missouri* 63166 (DF136160; F33615-76-C-3019)

The relevant problem of this effort is the need to increase the range and/or decrease the fuel requirements of military aircraft plus a need for increased fighter aircraft maneuverability. The objective of this program is to experimentally investigate several non-axisymmetric exhaust nozzle concepts to determine what range improvement and/or maneuver enhancement may be obtained when the nozzles are designed into a particular airframe.

During the initial phase of the investigation selected non-axisymmetric exhaust nozzles will be designed, fabricated and statically tested to determine their relative static performance. These nozzles will then be installed in an isolated pod/wing arrangement and tested in a wind tunnel to determine their relative thrust minus drag performance and lift enhancement plus vectoring/reversal capability. The acquired data will then be used to estimate the performance (including maneuver capability) of aircraft that have the non-axisymmetric nozzles installed.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXMB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0016, DEVELOPMENT OF BEACON COLLISION AVOIDANCE SYSTEM

UNKNOWN, Litchford Electronics Inc., *Northport, New York* 11768 (TS58995; TSC-1103)

The objective of this contract is to deliver experimental hardware and software for flight testing in order to demonstrate the feasibility of the Beacon Collision Avoidance System Concept in airborne operational environment, in the active, passive and semi-active mode, using the Air Traffic Control Beacon System (ATCRBS) transmission and beacon responses as the basis for an air-derived Collision Avoidance System (CAS). The intent is to provide an engineering system design which will define operation and provide documentation to enable an independent organization to prepare a complete B-CAS concept system specification following completion of the flight tests of the system.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0017, AIRCRAFT IDENTIFICATION BY WIDEBAND RADAR

P. RANKIN, Syracuse University Res. Corp., *Syracuse, New York* 13210 (DF742490; F30602-76-C-0098)

This effort will exploit wideband radar imagery techniques coupled with passive coding schemes to address the need for positive aircraft identification. Specifically, wideband radar returns and existing data processing schemes will be used to create a two-dimensional (range and cross-range) image of in-flight test aircraft. In addition, suitable passive coding of the aircraft will be implemented to demonstrate positive identification from processed flight test data.

Basically, the approach to be pursued is to use wideband radar data to produce and analyze high-quality two-dimensional radar images. Digital processing schemes will be used to obtain the Doppler spread from the amplitude and phase data in order to provide cross-range resolution. Target-range resolution will be obtained from the wide- bandwidth signal waveform. The combination of the range and cross-range resolution provides a high-

quality radar image of the target. The specific technical approach is summarized as follows: (1) Use the ALCOR c-band (500 mHz bandwidth radar) to obtain wide-bandwidth radar returns from a number of in-flight test aircraft; (2) Implement a passive coding experiment on at least one of the flight tests. This experiment will employ a passive scattering device whose characteristics can be coded to yield unambiguous identification; (3) Analysis will be performed to examine other coding schemes. This will include spatial diversity, i.e., locating of passive scatterers on various parts of the aircraft; (4) The wideband data obtained from in-flight tests will be analyzed to determine the effects of bandwidth reduction on high-quality images. Also, narrow-band data will be used to examine narrow-band feature characteristics of the test aircraft as well as narrow-band effects on the coding scheme; (5) A study will be performed to examine the impact of target imagery requirement on an s-band radar design.

ADDENDA: Supporting agency address is: Rome Air Development Center OCT, Griffiss AFB, N.Y.13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0018, SUPERSONIC JET EXHAUST NOISE INVESTIGATION (VELOCITY MODEL)

P. KNOTT, General Electric Company, *Cincinnati, Ohio* 45215 (DF455700; F33615-73-C-2031)

The overall objective of this program is to develop the technology to significantly reduce supersonic aircraft propulsion system noise with minimum associated performance and weight penalties. Emphasis is placed on afterburning and non-afterburning supersonic jet exhaust systems with operating conditions typical of supersonic transport (SST) and long- range strategic (B-1) aircraft propulsion systems. The specific technical objective of this research program is to develop a comprehensive mathematical model capable of providing aero/acoustic design data to be used in the development of future supersonic jet exhaust noise suppressors.

A detailed analytical and experimental program to develop a thorough qualitative and quantitative understanding of supersonic jet noise processes will be conducted. The effects of internal fluctuating forces in the nozzle on the downstream jet noise production process will be determined. The results will be correlated into a unified analytical model to aid in noise suppressor development.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0019, DAMAGE TOLERANCE GUIDELINES DEVELOPMENT

D. BROEK, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF135210; F33615-75-C-3101)

A new Air Force specification, MIL-A-83444, has been issued which requires that all primary structure be designed and qualified to be damage tolerant, i.e., to resist failure due to the presence of undetected damage such as flaws, defects, etc. The proposed guideline document will support these requirements and assist in complying with the detailed specifications. This procurement will help to insure increased safety and more cost-effective operation of future USAF aircraft.

The effort shall include a collection and evaluation of existing analyses, design and test technology, recommended methodology, and examples of application, which can be used by contractors in meeting the requirements of MIL-A-83444. The guideline document shall present data, rationale and bases for specific factors contained in MIL-A-83444, e.g., initial flaw sizes, residual strength loads, life factors, etc. Methods to be summarized include life prediction, residual strength and crack arrest.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0020, TRANSONIC WIND-TUNNEL EXPERIMENTS ON OSCILLATING AIRFOILS

S.L. PETRIE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF138650; AF-AFOSR-3021-76)

This work unit supports the aeroelastic evaluation of high-speed aircraft. It will contribute to the development of improved unsteady aerodynamic methods to predict aircraft aeroelastic stability and structural dynamic response. The goal is to develop a low-cost research facility to conduct unsteady aerodynamic tests on oscillating models in transonic wind tunnels, resulting in ultimate savings in the costs to design new aircraft. The presence of a national capability to make these measurements will allow the orderly development of necessary analytical methods to optimize aircraft structures for minimum weight and cost.

A contractor will be selected to survey the ambient interference in a small transonic wind tunnel without a model present. An oscillating model will then be inserted into the tunnel and studies performed to determine Mach number, Reynolds number and wall interference effects on unsteady pressure measurements.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBRB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0021, RPV FLYING QUALITIES DESIGN CRITERIA

C.F. PROSSER, Rockwell International Corp., *Columbus, Ohio* 43216 (DF135850; F33615-75-C-3159)

The state-of-the-art of remotely piloted vehicles (RPV's) is rapidly approaching the point where RPV's may be used as tactical weapon systems such as air-to-air combat and ground attack. Present RPV vehicles are now used operationally for target and reconnaissance missions. These vehicles are also being used in demonstration programs to determine the feasibility of tactical RPV's. As in the case of manned piloted aircraft, adequate flying qualities are required to enable the pilot/operator to perform the intended mission. Therefore, the objective of this program is to develop RPV flying-qualities design criteria. These criteria will be used to develop an eventual coordinated tri- service general remotely piloted vehicle (RPV) flying-qualities specification and background information and user guide similar to MIL- F-8785B (ASG), the military specification for flying qualities of manned airplanes. The specification will include design criteria for both manual modes and automatic modes by using the concepts of manned aircraft criteria as a baseline.

This program is the continuation of work initiated under in-house work unit 82190514 and will be the contracted portion of phase II described in AFFDL-TM-75-21, 'Technology plan for the remotely piloted vehicle flying qualities requirements and specification development program.' Phase II is divided into two sub-phases, Phase IIA in FY76 and FY77 and Phase IIB in FY77. This will be followed by a three year third phase. Contracted analyses and simulation studies will be used to develop the RPV flying-qualities design criteria which will significantly impact near-term RPV weapon system procurements.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0022, AIR FORCE AIRCRAFT STRUCTURAL FATIGUE DAMAGE SENSOR EVALUATION

R.A. CROUCH, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF120640)

USAF aircraft are subject to damage due to structural fatigue and constant surveillance is necessary to prevent catastrophic failure and compromise of mission as well as to reduce the cost of airframe reliability and maintainability programs. A low-cost method to provide this surveillance may be by use of fatigue damage sensors which are mounted to the airframe and continuously integrate the cyclic load experience which causes fatigue cracking. This effort is to develop and evaulate candidate fatigue damage sensors which are based upon the permanent electrical resistance change in an annealed foil grid when subjected to cyclic loads. Specifically, this effort will establish the degree of correlation between the sensor response and fatigue experience of test specimens for constant amplitude cyclic loads.

The experimental sensors, including mechanical strain multiplier types, will be appraised after exposure to various constant amplitude cyclic strain loadings while attached to axial and bending test beams. The response slopes, threshold sensitivities, usable life expectancy, and repeatability characteristics will be determined.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBT, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0023, CATEGORY III OPERATIONS PROCEDURES
R.J. HOVDE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134820)

Operational procedures for aircrew and air traffic control during category III operations are essentially non-existent. The objective is to develop operational aircrew and air traffic control (ATC) procedures which will allow routine category III weather operations.

Based upon baseline performance and failure analyses, aircrew and ATC procedures will be established to insure flight safety. These procedures will be used to fly actual weather approaches, during which aircraft separation criteria, ground control procedures and refinements to the aircrew and ATC procedures will be developed. After sufficient experience in the low-visibility environment is gained, different aircrew procedures will be investigated, varying the workload and the displays to be monitored.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FGT, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0024, FLIGHT PERFORMANCE ANALYSIS AND DESIGN METHODS
D.T. JOHNSON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136190)

In the design or evaluation of military flight vehicles performance analysis is the key item in the overall assessment. Currently methods are lacking in speed of application or are technically deficient for certain vehicle applications. To upgrade our capability, reduce costs associated with concept evaluations, this effort will provide a comprehensive performance and trajectory analysis package. The emphasis of this effort will be on the reduction of resources required to conduct performance analysis.

A fundamental library of performance programs currently exists which will be the basis of the effort. Such items as common input data, plotting will be added to existing programs; in other cases analysis will be conducted to develop small rapidly running programs. Modifications will also be made to assure rapid rapid convergence on the solution.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXGA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0025, RECOVERY SYSTEM PERFORMANCE AND SIMILARITY
R.E. MCCARTY, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF136590)

Recovery systems are used throughout the military in cargo delivery, aircraft spin recovery, emergency crew escape systems, weapons delivery and many uses associated with developments of other military systems where recovery of costly hardware is important for reuse during the development program although the recovery system would not appear in the operational version of the system. An example would be missile developments. These unique and varied requirements present a constant need for the low-cost development of minimal-weight recovery systems of maximum capability. This effort is directed toward achieving these goals through development of parachute model laws and valid analytical performance prediction techniques in areas of parachute canopy structural loading, inflation dynamics and forces and dissipation of landing impact energies.

Experimental test program will be accomplished in the AFFDL vertical wind tunnel (VWT) and the National Parachute Test Range to acquire data on the canopy cloth stresses realized during the inflation of model and full-scale canopies. Data will be utilized to validate and/or modify a finite-element computer program for predicting these cloth stresses. Scale-model canopies will be tested in the AFFDL horizontal wind tunnel to establish scaling criteria for simulation of full-scale canopy inflation under 'finite mass' conditions. Mathematical models will be developed which can be used to assess the landing impact environment in RPV structures, generate design input for attenuation systems and evaluate attenuator performance. Tests of solid and thin shelled bodies of revolution as well as rigidized intermediate parachute shapes will be performed in the AFFDL VWT to acquire drag measurements under non-steady flow conditions for subsequent derivation of 'apparent mass' relationships.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FER, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0026, COMPUTERIZED PROCEDURE TO ASSESS TURBINE ENGINE NOISE/PERFORMANCE TRADES
R. MCGREGOR, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF453910)

The objective of this program is to develop an effective design procedure relating aircraft engine performance and noise. The specific technical objectives of this program are: (a) to develop effective uninstalled engine noise prediction methods applicable to current and future aircraft gas turbine engines, (b) to develop techniques for the prediction of installed engine noise levels including the effects of special noise reduction devices, and (c) to develop methods to assess propulsion performance and weight penalties as a function of noise level reduction.

This in-house program is comprised of three phases. Phase 1 consists of the review and evaluation of all significant turbine engine noise prediction methods, verification of the accuracy of these methods by comparison with currently available or newly generated acoustic data, and the modification and refinement of these methods where necessary. Phase 2 consists of the development of the required techniques to interface selected noise prediction methods with existing performance and weight prediction methods as well as the development of techniques to predict the effects of installation of special noise reduction devices. Phase 3 consists of the application of the final noise- performance trade procedure to selected known systems in order to verify its effectiveness.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0027, VIBRATION AND AEROELASTICITY FACILITY IMPROVEMENTS
G.A. PLZAK, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF132470)

The problems of inadequate space and laboratory facilities prevent efficient and timely performance of the mission of the Vehicle Dynamics Division which includes the development of technology to predict, prevent, and control dynamics problems in flight vehicles. The objective is to acquire a facility which will provide the capability for ground test, flight test preparation, laboratory test, and analyses necessary for timely solution to these problems. Trends toward more complex structures and numerous combinations of external stores have resulted in serious aircraft dynamics and flutter problems in addition to stores compatibility.

A study contract has been let by ASD Civil Engineering to determine manning usage of existing buildings, equipments required, and evaluation of non-duplication Of existing facilities within the government or commercial concerns. The effort under this work unit will be concerned with technical evaluation of the contractor's reports and acquisition and checkout of the various equipments to be installed in the facility. Planned equipments include a multiple shaker system, a high-force shaker system, a shock machine, and new mobile facilities (vans). In addition, updating of existing vans with new equipment is included in this work effort.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBGB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0028, SIMULATION VERIFICATION AND IN-FLIGHT CORRELATION
J.J. POLLARD, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF137540)

The use of engineering and training flight simulators has reached an unprecedented level within the U.S. Air Force. To date no significant attempt has been made to verify positive correlation between ground- based simulators, in-flight simulators, and the actual vehicle. The primary objective of this effort is to demonstrate the degree of fidelity and realism presented by each of several simulation means in comparison with the actual flight test/operational vehicle. Secondary objectives include analyses of the effects of varied motion, visual, and flight configuration conditions.

Several tasks will be selected, such as landing flare and touchdown, and air-to-ground weapons delivery. Quantitative measures of pilot/vehicle performance will be obtained as well as applicable physiological and scanning data. The Lamars simulator will be utilized as the ground-based simulator with the Calspan Corporation providing the NT-33S for in-flight simulation. The cooperation of an ASD SPO will be required to allow flight test of the subject vehicle. All systems will be subjected to a scientifically structured test matrix utilizing the same pilots to the extent feasible. The final product should provide insight into simulator requirements and aid simulator technology advancement.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FGD, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0029, EVALUATION OF FATIGUE-RATED FASTENERS USED IN MILITARY STRUCTURES
J.M. POTTER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF128840)

Several manufacturers have offered the Air Force and its prime contractors newly designed fatigue-rated fasteners which they claim to be inexpensive, easy to install and yet have equal or better performance than the tapered bolt interference fit fastener presently used in current military aircraft structures. However, very little substantiating test data exist and in most cases, there is a complete lack of any objective, unbiased, comparative data. The objective of this program is to obtain and evaluate performance data for current and new 'fatigue rated' fasteners used or proposed for use on military aircraft structural joints. This data base will lead to increased system reliability and reduced cost over a life cycle.

Initial screening tests will be accomplished on structural components joined by the various fatigue-rated fasteners to obtain a relative comparison of fatigue lives. Those fastener systems that show promise for improved fatigue life will be subjected to more extensive evaluation. It is anticipated that constant-amplitude and spectrum loading will be utilized. Joints will be designed to provide no, low, intermediate and high load transfer through the fastener. Various hole preparation schemes that are intended to improve the fatigue life of joints will also be included in the investigation. Results will be evaluated and guidelines for the use of fatigue-rated fasteners will be established.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBEC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0030, MODEL INSPECTION TECHNIQUES FOR ADVANCED MILITARY AIRCRAFT BY USE OF COORDINATE MEASURING MACHINE AND DIGITAL COMPUTERS
T.F. SABICK, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131500)

Simulating the performance of advanced AF flight vehicles in ground test facilities requires the fabrication of precise three-dimensional aerodynamic surfaces. Measurement inspection of three-dimensional test articles prior to testing is necessary in order to assure adequate simulation. The objective of this endeavor is to increase the scope and capability of the measurement inspection system so that manual data processing and handling will be minimized. Advancing inspection techniques will not only reduce test lead time but lower production and operating costs.

Analysis of coordinate inspection data over a period of time has shown that a review of the present hardware and inspection techniques is in order. Several problem areas have arisen in data repeatability which result in deviations much larger than the machine absolute accuracy. Therefore, a new measurement probe that will minimize these errors will be designed, fabricated and tested.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXNA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0031, DATA ACQUISITION SYSTEM DEVELOPMENT FOR LABORATORY ACOUSTIC SIMULATION TESTS OF AIR FORCE AIRCRAFT AND COMPONENTS
R.C. TAYLOR, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF133290)

Test programs in laboratory simulated environments are conducted to alleviate and control acoustically induced fatigue and vibration problems in aircraft and missile systems in order to increase safety, reliability and maintainability. Highest quality analog data acquisition channels are essential to the production of useable test data from these tests. The objective of this program is to develop a data acquisition system which has the capability to insure the attainment of the desired test condition and which can provide a feedback function available for the development of a control system for the acoustic environment in the facility. Such an acquisition system is required to provide the standards of test procedure which can protect a delicate test specimen against damage resulting from overtesting and can insure that the required test environment was indeed provided. Substantial savings can be realized from such pre-launch testing for missile systems by preventing failure of the missile when operated in the dynamic operational environment. Highly accurate environment definition will enable the prediction of maximum lifetime available in existing Air Force systems leading to an increase in their useful life.

Develop a digital system to incorporate latest state-of-the-art solid-state, automatic gain changing amplifiers, developed under contract, into the sonic fatigue facility data acquisition system. Devise techniques to identify, display and condition each data channel to provide a signal available for use in a feedback control system in addition to providing an accurate time history for detailed analysis. Extend bandwidth of acquisition system to accommodate ultra-sonic data samples and develop compensation techniques to eliminate excessive calibration time. Develop an interface to provide for future digital computer control of data acquisition functions and to provide for the incorporation of feedback control of the acoustic environment.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBFB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0032, DEFINE THE LOADING ENVIRONMENT OF AEROSPACE VEHICLES FOR THE DEVELOPMENT OF DESIGN CRITERIA
E.W. TURNER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131870)

One broad problem which the USAF must address is the design and fabrication of aerospace vehicles which have both high reliability and low life-cycle cost. Achieving these mutually conflicting goals requires a detailed knowledge of the loading environment to be used in developing valid design criteria, and advanced methods for computing the response of aerospace vehicles to this environment. The objective of this effort is to extend the present knowledge of the loading environment by acquiring and analyzing flight data, and developing techniques for computing the response of aerospace vehicles to the environment. This will lead to higher reliability and lower life-cycle costs of aerospace vehicles.

A large collection of gust data is available from the previous critical atmospheric turbulence (CAT) recording programs. The aircraft structural integrity program (ASIP) is the primary source of operational flight loads data. Complementary data will be obtained from other recording programs conducted both by govern-

ment agencies (including the AFFDL), and nongovernment agencies. The AFFDL recording programs will be conducted by installing special sensing and recording devices on both manned and unmanned flight vehicles, and flight simulators. Flight recorders will be developed when necessary to fulfill the future requirements of AFFDL recorder programs. Current data processing techniques will be used to reduce the data, and new techniques will be developed when existing techniques are inadequate. New methods will be investigated, and computer programs implemented to compute the response of aerospace vehicles to the gust and maneuver loading environment.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0033, EVALUATION OF ADHESIVE BONDED STRUCTURES IN SIMULATED HIGH-INTENSITY SOUND ENVIRONMENT FOR ADVANCED MEDIUM STOL TRANSPORT AIRCRAFT

H.F. WOLFE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134200)

New aircraft structural joining processes have recently been developed. Two examples are the bonded joint which uses a structural adhesive in the joint rather than the conventional rivet and the weldbonded joint which uses an adhesive and a spot weld in the joint. These techniques are expected to result in stronger fatigue resistant and lower cost structural joints. An advanced development program by the AFFDL is studying the application of bonded structures to military aircraft. The objective of this program is to determine experimentally the sonic fatigue characteristics of weldbonded and bonded joints and to develop sonic fatigue design data for both types of joints.

A comparative investigation of the sonic fatigue resistance of one type of bonded, weldbonded, and riveted structural component in a simulated acoustic environment will be made. Simple test beams and sonic fatigue test panels will be fabricated using the three joining techniques. Structural mode shapes, damping and sonic fatigue life will be determined. These data will be incorporated into existing sonic fatigue design criteria.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBFA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0034, ELASTICALLY TAILORED COMPOSITE WINGS FOR LIGHT AIRCRAFT

W.J. DWYER, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Improvements in the performance of light aircraft possible with composite construction are being investigated. The elastic characteristics of relatively inexpensive filamentary composites, such as fiber glass- epoxy, are being tailored to modify the behavior under load of light aircraft wings.

SUPPORTED BY University of Texas

1.0035, HT 76-6 C-81 ROTORCRAFT ANALYSIS CORRELATION WITH AH-1G OPERATIONAL MANEUVER FLIGHT TEST DATA

G.T. WHITE, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D4025)

This research investigation will provide a modest correlation between the Army's digital computer program (C-81) and AH-1G helicopter flight test data. An estimate of 0.3 professional man-years has been made for this study.

The latest version of the C-81 rotorcraft flight simulation program (AGAJARMY) will be used. The data for the study will be provided under a contract entitled 'Aerodynamic and Structural Loads Survey of a Helicopter Rotor During Operational Maneuvers (AH-1G)'. The study will examine the capability of the C-81 program to predict teetering rotor helicopter trim, stability, control and dynamic loads.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R&D Lab, Eustis Directorate, Ft. Eustis VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, NAVIGATION - SUPPORT FOR SATELLITE NAVIGATION SYSTEMS AN/WRN-4

L.E. GANTER, Magnavox Company, *Fort Wayne, Indiana* 46804 (DN123404; N00014-71-C-0175)

Advance design satellite navigation equipments model AN/WRN-4 have been procured in limited quantity to provide high-accuracy, all-weather, global positioning capability required to support at-sea R/D efforts. These systems are fully automatic, completely integrated, compact in size and lightweight to facilitate transfer between users while preserving high reliability and maintainability. Centralization of spare parts and repair facilities for those sophisticated and unique equipments assures continued quality control, accurate performance history and minimum investment in back-up spares.

The investigator will provide a bonded warehouse for maintaining a pool of spare parts purchased under NR 083-260; will provide a supervisor to maintain liaison with equipment users in equipment trouble shooting and spare parts replacement; will maintain inventory records, parts failure analyses and equipment performance data; will ensure timely repair of faulty parts, their inspection and their return to stock in accordance with proposed procedures, with funding limitation prescribed; will maintain three GFE model AN/WRN-4 (MX706MA) equipments for emergency back-up equipments spares; and will provide support for software modifications required as specifically directed.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

2.0002, SILVER HYDROGEN ENERGY STORAGE

G. HOLLECK, E I C Incorporated, *Cambridge, Massachusetts* 02139 (DF459510; F33615-76-C-2093)

To determine the feasibility and develop design data for a 35 watt- hour/pound silver-hydrogen cell capable of 500 deep discharge cycles and 1 year life in satellite applications.

The primary effort is an experimental screening of cell components, cell component arrangements, and operating parameters in a number of versatile, small-capacity, boilerplate test cells. Secondary efforts involve development of a design concept and computer model of a cylindrical cell configuration, and design, fabrication, acceptance test and delivery of lightweight full-size cells of stacked disc and possibly cylindrical designs.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory POE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

2.0003, EXPERIMENTAL DESIGN AND ANALYSIS OF MEASUREMENTS FROM ROCKET AND SATELLITE INVESTIGATION

L. BURKE, Regis College, Undergraduate School, *Weston, Massachusetts* 02193 (DF243670; F19628-75-C-0081)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of the electrical properties of the ionosphere and magnetosphere for design needs of AF systems. Research - design of rocket and satellite experiments, analysis and synthesis of rocket and satellite probe results. How research contributes - permits improved military space vehicle design, provides data essential for radar propagation predictions, provides data essential for the design and utilization of communications, guidance and surveillance systems and provides understanding of dynamical processes in the ionosphere and magnetosphere. It contributes to the understanding of spacecraft charging and provides recommendations for the solution of charging problems. The objective of this work includes the design of instruments for the study of electric fields and plasma motion in the outer atmosphere and the analysis

and synthesis of space flight results. Studies include the determination of high-latitude current systems, ionosphere-magnetosphere coupling mechanisms and the significance of plasma turbulence and motions.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, PHYSICAL METALLURGY OF BETA-TITANIUM ALLOYS

S.M. COPLEY, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF039810; AF-AFOSR-2766-75)

AF function - the need for a low-density replacement for nickel- base alloy disks and blades in the terminal stages of compressors in gas-turbine engines has been pointed out in Air Force research objective 2.1.1.2. Opportunity - precipitation strengthened beta-titanium alloys are a promising new type of alloy that warrants further investigation as a potential replacement alloy. However, very little is known about the physical metallurgy of such alloys. Objective - this research will obtain an understanding of phase equilibria and the interrelationship of microstructure and properties in beta-titanium solid solutions strengthened by the precipitation of intermetallic compounds. How work contributes - this understanding is essential to fully assess their potential as gas-turbine materials and, if warranted, to facilitate their development for high-temperature applications.

Specifically, this is a basic investigation of phase equilibria in the Ti-(V, Mo, Cr)-Al-(Si, Ge) quaternary system. Of particular interest are the stability limits of the beta solid solution and the boundaries of the beta-gamma (TiAl) phase field. The approach includes microstructural analysis employing techniques such as transmission electron microscopy, X-ray analysis and electron probe microanalysis.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0002, MECHANISMS OF EXO-ELECTRON EMISSION IN STRUCTURAL MATERIALS

O. BUCK, Rockwell International Corp., *Thousand Oaks, California* 91360 (DF038440; F44620-74-C-0043)

AF function - aircraft structures of aluminum and titanium are subjected to cyclic loading and develop areas of weak mechanical properties by the process of fatigue. Opportunity - many metal components are removed from service when experience has shown that the fatigue state is questionable. Considerable savings could be realized if a quantitative measurement allowed additional safe operational use of these components. Objective - this work seeks to quantify the state of fatigue by nondestructively evaluating the fatigue-enhanced photoemission of aluminum. How work contributes - to reliability of aircraft aluminum and titanium structures.

The origin and mechanism of emission of electrons from fatigued metal surface will be studied. The quantity and energy distribution of the electrons will be correlated with oxide thickness, surface roughness, fatigue state, and frequency of photostimulation. Pure aluminum and Al 1100 with small copper additions will be used in the work-hardened and fully annealed states.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0003, LATTICE DYNAMICS IN AMMONIUM PERCHLORATE

T.B. BRILL, Univ. of Delaware, School of Arts & Sciences, *Newark, Delaware* 19711 (DF017810; AF-AFOSR-2131-71)

This research supports Air Force needs through a fundamental examination of the combustion properties of operational solid rocket propellant oxidizers. The research is aimed at determining some of the fundamental effects of temperature, pressure and catalytic dopants on the crystal lattice of the principal solid propellant oxidizer, ammonium perchlorate. The research has also been expanded to include a study of the decomposition of HMX. The light-scattering technique of laser Raman spectroscopy is being employed in all cases to determine the dynamics of the compounds from the standpoint of internal and lattice vibrations. The variable-temperature work should aid in understanding how these propellants behave in the pre-combustion temperature domain. Of particular interest is the composition of the solid and melt phases in each case. Such information has considerable significance to the formulation of complete mechanisms describing early combustion events. The pressure dependence work on AP relates directly to the combustion process because the propellant is known to liquify under pressures similar to the propellant combustion chamber. Catalytic dopant effects on the crystal lattice of AP are being examined to determine whether they produce observable modifications to the crystal which might relate to the low-temperature decomposition of the ammonium perchlorate to ammonia and perchloric acid.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0004, STRUCTURE AND PROPERTIES OF GLASSES

P.B. MACEDO, Catholic University of America, School of Engin. & Arch., *Washington, District of Columbia* 20017 (DF033010; AF-AFOSR-2203-72)

Air Force interest in glass as a basic constructive material is twofold. As a fiber-optic material its unique properties make it useful for special communicative applications where resistance to damaging radiation is desired. Also special glasses are desired for high- strength, impact-resistant enclosures for aircraft. This research will continue efforts to elucidate the nature of viscoelastic behavior of glasses and liquids. These include (1) a study of thermal enthalpy relaxation in commercially important alkali-lime-silica glasses and comparison of the results with relaxational studies of other properties, (2) a characterization of the glassy crystal transition in plastic crystals and comparison with the ordinary glass transition in liquids, (3) a complete relaxational study using all available techniques on a carefully selected specimen liquid, and (4) a study of rotational effects on viscoelastic behavior in liquids by means of light scattering.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0005, DOUBLE-LAYER STRUCTURE AND ELECTRODE KINETICS

R. DELEVIE, Georgetown University, School of Arts & Sciences, *Washington, District of Columbia* 20007 (DF043940; AF-AFOSR-3027-76)

AF function - electrical power for aircraft, satellite, and various subsystems is the source that keeps our communication systems and flight operations active. Deficiency - longer life, lighter weight, higher energy-density batteries are needed to meet the various operational requirements of the Air Force. Objective - investigations will be carried out on the double-layer structure at the electrolyte/electrode interface by a combination of recently developed techniques. These methods will be used to test and calibrate liquid metal electrodes and solid electrodes. How work contributes - information on specific adsorption and on double-layer potentials crucial to the refinement of electrode kinetics, electrocatalysis, and problems related to the electrode/electrolyte interface.

Using the recently developed technique, the kinetic probe method, double-layer potential measurements will be made on electrolyte mixtures and solid electrodes. This method will be applied to the study of ionic strength mixtures of alkali fluorides, pseudohalides, nitrates and perchlorates, as well as aqueous buffer mixtures such as phosphate, citrate, and borate. The results will be directly useful for kinetic investigations. Kinetic probes

will be used to study double-layer potentials at the solid electrode/water interface, i.e., platinum, nickel, zinc and various carbons. Attempts will be made to apply bubble pressure, ultra-fast admittance (Fourier-transform), and kinetic probe techniques to double-layer effects on ion adsorption isotherms in dilute solutions, and to the simultaneous measurement of kinetic and thermodynamic data where electrochemical reactants, intermediates, or products are strongly adsorbed.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0006, NAVAL VEHICLE TECHNOLOGY - FUNDAMENTALS OF ADHESION

W.D. BASCOM, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN120012)

To improve the reliability of adhesive bonds in naval aircraft construction. The use of structural adhesives in aircraft construction offers many advantages over other fabrication methods, but the bonds are susceptible to attack by moisture and to fatigue failure. Rational approaches to solving these problems require a knowledge of failure mechanisms.

The effect of water on bond strength is being investigated using double cantilever beam specimens and other adhesive joint geometries. Variables include adhesive resin composition, metal type and prebonding treatment of the metals. The metal surfaces are examined before bonding and after failure using scanning electron, microscopy, light microscopy and various surface analysis techniques.

ADDENDA: Supporting agency address is: Naval Air Systems Command (52032), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0007, FINITE-ELEMENT ANALYSIS OF ELASTIC-PLASTIC THREE-DIMENSIONAL CRACKS

S. ATLURI, Georgia Inst. of Technology, School of Engineering, *Atlanta, Georgia* 30332 (DF038620; AF-AFOSR-2667-74)

AF function - airframe and engine structures of advanced aerospace vehicles require efficient and accurate analysis methods to assess failure processes. Deficiency - insufficient understanding and analysis methods exist in order for the air force to reliably design and maintain flight vehicles at cost and safety factors which are acceptable. Objective - the objective of this research is to develop new hybrid finite-element analysis techniques, considering nonlinear material behavior and three-dimensional response, for studying the behavior of cracks and crack growth. How work contributes - this research will provide Air Force development programs and Air Force contractors with advanced techniques to improve structural reliability and damage tolerance.

This research uses as a basic technique the displacement hybrid finite-element approach. The approach has been used to study two- dimensional elastic fracture mechanics. This basic work is now being extended along two lines, the first being to include plasticity in the study of plane problems. This research will be extended to examine the t-integral, crack tip blunting and stable crack growth. The second area is to incorporate the nonlinear materials behavior in three-dimensional analysis studies of arbitrarily shaped cracks.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0008, THE EFFECT OF MICROSTRUCTURAL FEATURES ON THE RESPONSE OF ALUMINUM ALLOYS TO CYCLIC DEFORMATION

E.A. STARKE, Georgia Inst. of Technology, School of Chemical Engineering, *Atlanta, Georgia* 30332 (DF037750; AF-AFOSR-2615-74)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. Opportunity - in fact, the fatigue properties of structural materials often limit their application. Thus, it is important to understand the mechanism of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Objective - this research will determine the effects of microstructural features on cyclic deformation modes. In particular, it will clarify certain ambiguities concerning cyclic softening behavior of age-hardened aluminum alloys, and distinguish those features which cause the low fatigue stress/tensile strength ratio inherent in these materials. Contributes - to reliability of aluminum airframe structure.

Since aluminum alloys form a major portion of the material currently used for skin and other structural airframe applications, it is appropriate that they are the basis of this investigation. The broader fundamental understanding of the fatigue behavior of aluminum alloys to be developed during the course of this research will provide the basis for carrying out future alloy and process development to achieve improved materials. In addition, the principles developed during the course of this investigation should also be applicable to other age- hardening systems.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0009, RADIATION HARDNESS OF QUARTZ

A. KAHAN, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF245170)

Af function - reconnaissance, surveillance, navigation, communications command and control. Deficiency - AF satellites require highly accurate and precise timing mechanisms to fulfill properly mission requirements. Currently used timers are susceptible to knockout major and/or spurious operation under influence of natural or man-made radiation. Objective - to specify the growth conditions for quartz crystals which, when processed into timing devices for AF systems, will be unaffected by natural radiation and which will have improved hardness in man-made radiation fields. How research contributes - this work will provide manufacturers of quartz ingots with certain processing information which will allow production of quartz of use in hardened oscillators. This information includes conditions of crystal growth, dopant type and concentration and electrical processing of the final ingot before device fabrication.

The approach is to evaluate the radiation susceptibility of quartz oscillators at a variety of radiation levels. These oscillators are produced from quartz fabricated in several specified dopant modes. After radiation exposure, resonator and oscillator measurements are made, IR spectroscopy of the material is carried out to document type and quantity of impurities present. Results are correlated with electrical sweeping preparation of samples to determine optimum sweeping parameters. Final result should yield growth and processing parameters for quartz ingots which will yield oscillators with improved frequency stability in a radiation environment.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LQ, L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0010, HIGH-TEMPERATURE PROPERTIES OF EUTECTICS AND DIRECTIONALLY SOLIDIFIED ALLOYS FOR POTENTIAL ARMY AIRCRAFT ENGINES

P.J. AHEARN, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0C4808)

High-temperature materials are required for a number of Army applications which must show high strength and long time microstructural stability. Ease of fabricability of large sections is often a second criterion. Properly chosen eutectic alloys may provide the optimum turbine blades and vanes.

High-strength castings of eutectic alloys will be prepared. Mechanical properties of eutectics are influenced by the solidification parameters. Currently properties are optimized by rapid cooling in combination with directional solidification. This procedure has practical limitations and thus experiments will be conducted to develop an alternate technique. Major emphasis will be placed upon structural modifications resulting from controlled liquid flows at the solidification interface. Modulated structures have been obtained by the technique. Further experimental adjustments should allow other interesting structural variations.

ADDENDA: Supporting agency address is: DARCOM Materials & Mechanics Research Center, Watertown, MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0011, LAVES PHASE FORMATION IN IRON-BASE ALLOYS FOR BEARINGS
W.F. CHIAO, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4797)

The objective of this investigation is to develop the optimum mechanical properties from the formation of laves phases by utilizing an Fe-9Ni-9Co matrix with Ti, Nb, Ta, and Mo, respectively, as the key element to the laves formation. The aim of this new design of alloy system is to produce a tough iron-base matrix with dispersed hard laves compounds more resistant to coarsening and thus more stable than carbide particles at elevated temperatures. These new ferrous materials will support the thrust survivability.

Investigative work will be concentrated on the new alloys of Fe- 9Ni-9Co-2Nb, Fe-9Ni-9Co-2Ta, and Fe-9Ni-9Co-Mo systems. The central tasks will be the evaluation of solution treatment and aging processes, the identification of laves compounds, and the development of optimum mechanical properties for these new alloys. The strengthening mechanism will be correlated with the formation, growth, and morphology of laves phases. From these resuits alloy compositions, structure, and thermal treatments will be developed for the production of optimum mechanical properties.

ADDENDA: Supporting agency address information: AMC Materials & Mechanics Res Ctr., Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0012, ENVIRONMENT - FATIGUE INTERACTIONS IN FIBER-REINFORCED COMPOSITES
M.E. ROYLANCE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4742)

To assess the influence of an accelerated environment (high temperature, humidity, and ultraviolet radiation components) on the fatigue lifetime of fiber-reinforced polymer composites, to identify material degradation mechanisms, and to optimize the environmental fatigue resistance of these composites for use in helicopter rotor blades and flight control elements. Pacing problem areas (from FY76 guidance, materials technology plan for aircraft) - 1.5, 1.6, 2.1, 2.2, 2.3, 2.4, 2.8, 9.1, 9.2. Major program thrust - 11.G.2 (aircraft survivability).

Various thermosetting and thermoplastic matrices, reinforced with glass, graphite, and kevlar fibers, will be fabricated by means of a wide variety of processing methods and subjected to cyclic tension- tension fatigue loads while exposed to an accelerated deteriorative environment. Statistical lifetime distributions will be obtained as a function of mean load, and the data correlated with current theories of cumulative damage and crack growth in composites. Materials deterioration mechanisms will be identified by analytical chemical and microscopy techniques, and processing methods will be developed to eliminate or minimize these mechanisms. Mechanical loss and stiffness, and specimen temperature, will be monitored to develop measures of fatigue damage. Piezoelectric polymers will be assessed as possible damage monitors.

ADDENDA: Supporting agency address is: DARCOM Materials & Mechanics Research Center, Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0013, ENERGY CONDUCTION IN MOLECULAR ALLOYS
R. KOPELMAN, Univ. of Michigan, School of Lit. Sci. & the Arts, *Ann Arbor, Michigan* 48104 (DMR75-07832-A01)

Reseach will be carried out to study energy transport via electronic and vibrational exciton conduction in molecular solids. These studies will include dynamic exciton percolation in multicomponent 'molecular alloys' with exciton insulator to conductor transitions, the long-range triplet exciton interactions, and also excitonic switching via pressure and temperature using dye lasers. Exciton-phonon interactions will also be studied.

This is a continuation of research supported under DHR-7202955.

SUPPORTED BY U.S. Natl. Science Foundation

3.0014, ENERGY AND MOMENTUM EXCHANGE BETWEEN SOLIDS AND GASES
L.B. THOMAS, Univ. of Missouri, Graduate School, *Columbia, Missouri* 65202 (DF042550; AF-AFOSR-2934-76)

Air Force function - aerospace vehicles. Deficiency - lack of knowledge of interactions of gas molecules with solid surfaces. Objective - to complete additional measurements of clean-surface tangential momentum accommodation coefficients on magnetically suspended, spinning balls, and to analyze and prepare for publication a large body of data compiled from the previous work of the principal investigator on momentum and energy accommodation on surfaces of known cleanliness or known coverage with gas molecules. How contributes - by making generally known the physical details of these interactions and the conditions governing them, it should be possible to make more accurate a-priori predictions of aerodynamic forces as well as to be better able to 'design around' gas contamination processes on spacecraft carrying optical and infrared or ultraviolet sensors or emitting devices.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0015, NAVY ENVIRONMENT - INVESTIGATION OF STAGE I FATIGUE CRACK GROWTH IN METALS
D.K. BENSON, Midwest Research Institute, *Kansas City, Missouri* 64110 (DN223017; N00014-71-C-0020)

Metals in cyclically stressed naval components, e.g., rotating shafts, vibrating airfoils, etc., often fracture in a fatigue mode. The objective of this research is to determine the factors affecting and controlling the early stages of this type of failure.

Stage I fatigue crack growth in copper, aluminum and copper- aluminum alloys is to be studied and correlated with stress intensity factor, cyclic strain, and environment--water vapor, atomic hydrogen, and vacuum. Testing will be performed in the push-pull mode using a cantilever test device. Growth rates will be determined by microscopic observation and by fractographic analysis. It is proposed to evolve a model for stage I crack growth.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0016, AN EXAMINATION OF THE EFFECTS OF CRYSTALLINE DEFECTS ON THE PHOTOVOLTAIC PROPERTIES OF CU2S-CDS SOLAR CELLS
K.A. JONES, Dartmouth College, Graduate School, *Hanover, New Hampshire* 03755 (DMR75-09329)

This study will focus on the influence of crystalline defects, especially misfit dislocations, on the photovoltaic properties of Cu2S- CdS solar cells. The study will primarily involve the use of CdS platelets because they can be grown relatively reproducibly. They can be grown with the dislocations, and their 'X' or 'Y' face orientation provides for a better lattice match with the Cu2S than does the 'Z' face. To reduce the effects of other orientation-dependent variables, cells will be fabricated from CdxZn1-xS and CdSxSel-x platelets and bulk CdS crystals with the same orientation. The electrical characteristics of the cells will be determined by their light and dark I-V curves and their spectral responses; the surface morphology will be examined using scanning electron microscopy (SEM), and the crystalline defects will be analyzed using Lang X-ray topography and transmission electron microscopy (TEM).

In order to make the results meaningful, the other variables will have to be controlled. This will be done by growing the platelets and films under the same conditions. The platelet thickness and the platelet and film morphology will be monitored in an SEM; the electrical properties of the platelets will be monitored using a DC Hall effect device, and the platelet orientation,

Cu2S crystal structure, and the defect structure of the platelet and film will be examined using X-rays and a TEM.

SUPPORTED BY U.S. Natl. Science Foundation

3.0017, FATIGUE CRACK NUCLEATION AND PROPAGATION IN ALPHA-BETA TITANIUM ALLOYS
H. MARGOLIN, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn*, *New York* 11201 (DF040010; AF-AFOSR-2774-75)

The longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. In fact, the fatigue properties of structural materials often limit their application. Thus, it is important to understand the mechanisms of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Systematic studies of fatigue crack initiation and propagation in alpha-beta titanium alloys are of great interest to the Air Force, and would make a useful contribution to future development of engineering alloys. The objective of this research is to determine the relationship between fatigue properties and microstructure of two-phase (alpha-beta) titanium alloys. Specifically, the Ti-Mn system will be used as a model system for alloys consisting of two ductile phases. Alloy composition and heat treatment can be used to vary the volume fraction and morphology of the phases present, and thus, by this study, the most desired microstructures for fatigue resistance can be determined. Fatigue crack initiation and propagation characteristics will be related to microstructural features such as phases present, particle size and distribution, and dislocation densities. Monotonic and cyclic stress-strain curves will be determined for each alloy composition to aid in interpretation of fatigue data.

ADDENDA: Supporting agency address is: AF office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0018, THE MECHANISM OF FRETTING FATIGUE CRACK INITIATION IN STEELS 12554-MS
D.J. DUQUETTE, Rensselaer Polytechnic Inst., School of Engineering, *Troy*, *New York* 12181 (DA0U5576; DAAG29 76 C 0006)

To clarify the basic mechanism underlying the initiation of cracking under fretting-corrosion-fatigue in steels. Fretting and its ramifications in fretting-corrosion-fatigue have been of serious consequence in engine and rotating structural components of Army aircraft and such phenomena may be responsible also for some classes of problems in high-rate-of-fire weapons.

Studies will be made of how certain variables such as frequency, microstructure, relative hardness of surfaces, environment, temperature, and contacting surfaces, partake in the process of fatigue initiation in steels. From fretting fatigue studies conducted at constant strain conditions, quantitative information will be derived which will form the basis of a comprehensive theory for fretting-corrosion-fatigue of metals and alloys.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0019, THE ROLE OF INTERNAL ENERGY IN ION-MOLECULE REACTIONS 13186-C
T. BAER, Univ. of North Carolina, School of Arts & Sciences, *Chapel Hill*, *North Carolina* 27514 (DA0W5571; DAAG29 76 G0093)

The investigation of reactions which lead to the formation of ionic clusters including 0 4 (plus), (H20)NH (plus) and NO (H20) N (plus). Collision complex lifetimes will be studied and the photoelectron spectra of neutral clusters will be determined. The results of this research will provide insight into the mechanisms and rates of formation of cluster ions which are important species in the d and e regions of the atmosphere and hence to the BRL aeronomy program. In addition the results will be useful to the Detection Branch at EA.

Lifetimes of collision complexes will be measured as a function of both internal energy and of the relative translational energy of the collision partners using a double pulsing technique. Ionization processes will be investigated using a photoion-photoelectron coincidence technique. Use of this technique will provide for the determination of the photoelectron spectra of specific size clusters in a mixture of various cluster sizes.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0020, GRAIN ASPECT RATIO STRENGTHENING OF DISPERSION HARDENED METALS
B.A. WILCOX, Battelle Memorial Institute, *Columbus*, *Ohio* 43201 (DF032120; AF-AFOSR-2083-71)

The demanding requirements of high-performance aerospace vehicles make clear the need for materials with premium mechanical properties and resistant to environmental degradation. Dispersion strengthened metals and alloys are being used in the hottest sections of some gas turbine engines and their use is expected to become even more widespread in aerospace systems of the future, particularly where high-temperature performance is required. At such temperatures, all materials are subject to reductions in strength and creep (an insidious process of deformation not predicted by the usual concepts of yield stress). The objective of this research is to relate experimentally observed grain aspect ratio effects to realistic high-temperature plastic flow mechanisms, and to experimentally determine the influence of strain rate and temperature on the grain aspect ratio strengthening effect. Dispersion-strengthened nickel alloys will be used as experimental materials. Further understanding of grain aspect ratio effects is anticipated to yield significant predictive ability of the high-temperature performance of a number of alloy systems.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0021, SURFACE ENERGIES AND RELATED PROPERTIES OF BETA-TITANIUM ALLOYS
R. SPEISER, Ohio State University, School of Engineering, *Columbus*, *Ohio* 43212 (DF040460; AF-AFOSR-2799-75)

AF function - materials having better strength-to-weight ratios, high toughness and improved resistance to corrosion are being sought for aircraft and space vehicles structures. Opportunity - improvement in these properties depends a great deal on the surface and grain boundary energetics of alloys. Objective - this research will obtain surface and grain boundary energy data that will contribute directly to the understanding of the mechanical behavior of a class of alloys, beta titanium, that is of current Air Force interest. How work contributes - this work contributes to improved materials for airframe structures.

The higH-temperature zero-creep method and grain boundary grooving technique will be applied to study Ti-25 Mo base alloys and the consequences of small elemental additions to this base alloy. The surface, grain boundary, twinning and stacking fault energies thus derived will aid alloy design to optimize mechanical and environmental resistant properties.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0022, ALTERNATE FUELS COMBUSTION INVESTIGATIONS
U.N. GRIMM, U.S. Air Force, Aero Propulsion Lab., *Dayton*, *Ohio* 45433 (DF458210)

Expanded-specification petroleum fuels and fuels from oil shale and coal are being considered for future use in Air Force aircraft. The objective of this effort is to examine and quantify the effects of appropriate fuel character changes on the engine combustion systems. These findings will be used as a basis for decisions regarding: (a) the extent to which current systems can tolerate changes in fuel quality, (b) future modifications to combustion systems to allow use of reduced quality fuels, and (c) the trade-off of fuel processing cost versus the cost of modified combustor designs.

The program described below is part of an integrated plan with NASA Lewis Research Center to study the alternate fuels problem. Recognizing that design and thermodynamic conditions can influence the fuel effects, both older (T56) and modern (F101) systems will be studied for main burner characteristics. These investigations shall make use of the Room 20 Combustion Facility (see work unit 30480542). Data acquisition will be performed on a T56 single combustor prior to testing on the more complicated F101 sector system. A J85-5 engine will be used to investigate the influence of fuel quality on afterburner combustion performance (see work unit 30660532). The order in which combustion parameters will be studied is - combustor liner temperature, combustion efficiency, smoke emission, gaseous exhaust emissions, fuel bound n effects, blowout, ignition, stability to airflow transients, pattern factor, and deposition. The requirement to perform additional efforts oriented toward analytical modeling of important processes is evident.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory SFF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0023, FABRICATIONS AND INVESTIGATIONS OF NICKEL-CADMIUM CELLS FOR AEROSPACE POWER SYSTEMS

D.F. PICKETT, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF452180)

The objective is to acquire an in-house capability for fabrication of Ni-Cd cells, and cell components and to use this capability via innovative experiments to provide improved aerospace Ni-Cd batteries.

The technical approach being followed in this in-house effort is (a) establish charging efficiency for state-of-the-art cells, (b) establish parameters for a one-step electrochemical loading of electrodes with active material, (c) fabricate 20 cells using electrochemical methods and performance test, (d) publish reports on events (a), (b), and (c), (e) fabricate electrodes for nickel-hydrogen and nickel-zinc cells using both conventional and bipolar designs, (f) publish report on event (e), (g) repeat (c) for 200 cells having various plate additives and constructions, and (h) publish report on event (g).

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory POE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0024, HARD AND WEAR-RESISTANT MATERIALS

E. RUDY, Oregon Grad. Ctr. Stu. & Res., *Beaverton, Oregon* 97005 (DMR74-23256-A01)

This is a continuation and expansion of a research program designed to establish fundamental thermodynamic and processing alloy data for hard materials systems of potential interest to the tool industries. In the renewal period of three years, the following tasks will be undertaken: (1) Final assembly of the phase diagrams for the systems Mo-Cr-C and W-Cr-C based on experimental data established during the first two years of the program. (2) Establishment of the phase equilibria for the alloy systems Hf-Mo-C, Hf-W-C, V-Mo-C, V-W-C and Mo- W-C from 1400 degrees C through the melting range, and thermodynamic interpretation of the same. The phase diagram and thermodynamic data for these systems are necessary for an interpretation of the higher order systems Hf- (V,Ti)-(Ta,Nb,Mo-W)-C, which are of importance for the synthesis of new high-strength hard composites based on decomposition reactions in higher order monocarbide solutions. (3) Synthesis of new nitrides and carbonitrides, and extension of the spinodal alloy studies to include lower stability nitrides by high-pressure (approximately 1200 atm.) and high-temperature (approximately 2000 degrees C) reaction methods in an autoclave system currently under construction. (4) A cooperative effort with industrial organizations to evaluate the tool materials developed during the first two years will be initiated with interested industrial organizations. The tool materials include Ti-Mo- C- based, cemented carbides, steel cutting carbide grades formed by disproportionation of higher order carbide solid solutions, and CVD- coated tool inserts.

This is a renewal of NSF Grant GH-30875 (DMR7101752).

SUPPORTED BY U.S. Natl. Science Foundation

3.0025, SPATIALLY RANDOM MAGNETICA AND ALLOYS

R. TAHIRKHELI, Temple University, School of Liberal Arts, *Philadelphia, Pennsylvania* 19122 (DMR73-07651 A02)

Theoretical studies of inhomogeneous magnetic systems and the phenomenon of complicated magnetic ordering, previously carried out under GH-39023, will be continued. The spin dynamics of random paramagnetic systems will be studied both for the case of randomness of the occupation of lattice sites and of randomness of the magnetic interactions. Coherent potential techniques will be developed to treat excitations in site-diluted systems. Finally, the problem of biquadratic and quadrupolar interactions and their effect on magnetic ordering will be considered. In all of these studies, the Green's function method will be heavily relied upon.

SUPPORTED BY U.S. Natl. Science Foundation

3.0026, MECHANICS OF PRIMARY MICROSTRUCTURAL FEATURES OF TITANIUM

J.L. SWEDLOW, Carnegie Mellon University, Inst. of Technology, *Pittsburgh, Pennsylvania* 15213 (DF043480; AF-AFOSR-2993-76)

AF function - structural material reliability increases are necessary in order to reduce AF cost of ownership. Increased knowledge of crack initiation is a major essential need in prediction of total structural life. Deficiency - crack initiation life of both air frame structures and engine structures is not reliably predicted with existing theories of material and fracture behavior. Objective - the objective of this research is to apply finite-element analysis to titanium alloy microstructure in order to investigate strain localization, void formulation and crack initiation. How work contributes - this research contributes to Air Force technology requirements to increase the capability of accurately predicting structural material failure.

Physical metallurgists have long been concerned with relationships between microstructure and macro-behavior of structural alloys. Two models will be investigated for this information - first, the microstructure itself, its configuration and mechanical properties, and second, the sequence of events observed to occur when the alloy is subject to loading. Finite-element analysis techniques will be used to analyze observed experimental behavior.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0027, EROSIVE BURNING STUDIES OF COMPOSITE SOLID PROPELLANTS BY THE REACTING TURBULENT BOUNDARY-LAYER APPROACH

K.K. KUO, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (DF042260; AF-AFOSR-2914-76)

It is presently impossible to make an accurate prediction of burn rate of rocket motor propellant grains which burn erosively. This is highly expensive in added cost during development programs, due to the inaccurate prediction capability. The objective of this research program is to carry out fundamental studies on the mechanism of erosive burning frequently encountered in rocket motors. The problem of erosive burning will be analyzed in a realistic manner as a turbulent boundary-layer problem of reacting gases. The essence of the theoretical model is to incorporate the well-accepted granular diffusion flame theory, for composite propellants into the turbulent boundary-layer equations for chemically reacting gases. The effect of fuel pocket sizes on the increase of turbulence and the heat feedback to the propellant surface will be considered. Experiments will be conducted to verify the theoretical model. Instantaneous burning rates under erosion conditions will be measured by employing the newly developed laser photo-diode servomechanism technique. An erosive burning rate expression, based upon the governing dimensionless variables to be obtained from the theoretical model and the correlations obtained from experimental data, will be developed.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0028, MATERIAL REMOVAL PHENOMENA IN CERAMICS FOR AIRCRAFT AND MISSILE APPLICATIONS
P.J. GIELISSE, Univ. of Rhode Island, School of Engineering, *Wakefield, Rhode Island* 02881 (DN930028; N00019-73-C-0198)

To improve understanding and control of abrasive machining in order to improve strength and reliability of ceramics in stressed applications for aircraft and missiles.

Mostly single-point but some multiple-point grinding is being done on ceramic workpieces. Emphasis on the cutting element includes geometry, composition, velocity, environment, tool matrix, thermal properties and tool force. Emphasis on the workpieces includes characterization of the workpiece and swarf, identification of the stock removal mechanism, and workpiece dynamics.

Supporting agency address information: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0029, MECHANICS OF COMPOSITE MATERIALS WITH DIFFERENT MODULI IN TENSION AND COMPRESSION
R.M. JONES, Southern Methodist University, School of Engineering, *Dallas, Texas* 75222 (DF037040; AF-AFOSR-2532-73)

Air Force flight vehicles require improved structural performance and reliability to achieve future mission objectives. Composite materials for airframes, engines and reentry vehicles are under study by both the research and development communities as a structural material to meet the desired objectives. The principal objective of the proposed research is to analyze the behavior of three-dimensional bodies as well as laminated plates and shells with different nonlinear stress-strain behavior in tension and compression. That is, both of the two aforementioned composite material characteristics, different moduli in tension and compression and nonlinear stress-strain behavior, will be addressed. A secondary objective is to continue the studies of behavior of laminated plates and shells with different elastic moduli in tension and compression as well as with lamination asymmetries.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0030, NUCLEAR MAGNETIC RESONANCE AND ACOUSTIC NUCLEAR RESONANCE FOR NONDESTRUCTIVE EVALUATION OF STRUCTURAL MATERIALS
G.A. MATZKANIN, Southwest Research Institute, *San Antonio, Texas* 78228 (DF044200; F44620-76-C-0114)

AF function - the nondestructive evaluation (NDE) of aircraft structural materials plays an important role in safety and cost- effective use of the fleet. Deficiency - there is a deficiency in techniques for determining the residual stress and strains introduced into materials during fabrication or subsequent use. Such stresses play important roles in fatigue damage processes, stress corrosion cracking, and hydrogen embrittlement. Objective - this research seeks to apply nuclear magnetic resonance (NMR) and acoustic nuclear resonance (ANR) techniques to NDE problems of practical interest to the Air Force. How work contributes - the specific features of NMR and ANR will be defined and developed for the quantitative characterization of internal strain and stress in nonferromagnetic structural materials, such as Al, Ti, composites, and nonmetallics.

Inductive NMR signals will be detected from specimens external to both the detecting coil and the magnetic gap by utilizing a pancake- shaped detection coil placed near the surface of the specimen, with the applied field produced by u-shaped magnets. Continuous and pulsed ANR techniques will be developed for polycrystalline materials.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0031, KINETICS OF OXIDATION REACTIONS
R.R. BALDWIN, Univ. of Hull, *Hull, England, United Kingdom* (DF001950; AF-AFOSR-2450-73)

This research directly supports research objectives in propulsion and power through an examination of fundamental kinetic mechanisms inherent in rocket and turbojet combustors, nozzles, and plumes. Specific investigations are being pursued under this grant in an effort to supply definite answers to several of the difficult, controversial questions still remaining in the kinetics of the oxidation and combustion of hydrocarbons and related compounds. The systems under study include hydrogen-oxygen, hydrocarbon-oxygen, hydrogen-oxygen- carbon monoxide, hydrogen-oxygen-nitrous oxide, hydrogen peroxide, and aldehyde-oxygen. All of these systems are interrelated, each providing some precise information which helps the interpretation of the others. Experimental methods include following the slow reaction, and determining the explosion limits, using surfaces found by Professor Baldwin to give accurate and reproducible results. Besides temperature, pressure and concentration variation, important advances are being made by additives, determination of reaction intermediates, using sensitive gas chromatographic, mass spectrometric and other methods, variation of the type and area of the vessel surface, and isotopic substitution.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0032, FRACTURE OF METALS AND ALLOYS
H.G. WILSDORF, Univ. of Virginia, School of Engin. & Appl. Sci., *Charlottesville, Virginia* 22903 (DN023110; N00014-75-C-0855)

The goal of this research is to gain a better understanding of crack propagation and fracture processes occurring in metals and alloys. This knowledge will be useful in the development of reliable, crack- resistant alloys needed in advanced naval systems such as high- performance aircraft and deep diving submarines.

Crack propagation and fracture of various metals and alloys are being observed directly in a 500kv electron microscope. This allows dislocation interactions and fracture processes to be observed on a near atomic scale in specimens which exhibit bulk rather than thin film behavior. Correlation of experimental observation with theoretical fracture analysis is being undertaken.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, Va 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, RELIABILITY PHYSICS STUDIES ON DOPED ALUMINUM
J. BLACK, Motorola Incorporated, *Phoenix, Arizona* 85008 (DF735920; F30602-76-C-0300)

To provide funds for the study of doped aluminum conductor films in terms of their chemical and structural influence on integrated circuit reliability.

Appropriate test structures and IC's will be built with aluminum thin-film conductors doped with silicon or copper. Accelerated stress tests will be used to determine the chemical stability of these films, their resistance to electro-migration, their interaction with other device features such as deposited dielectric layers and silicon contacts. The information generated on this study will be used to enhance IC reliability through improved test methods and general device specifications. The end item will be a report.

ADDENDA: Supporting agency address is: Rome Air Development Center RBR, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0002, SOS FILM STUDIES
UNKNOWN, Rockwell International Corp., *Anaheim, California* 92803 (DF900660; F19628-75-C-0108)

AF function - radiation hardness of Air Force space and missile systems. Deficiency or opportunity - current nuclear hardness requirements for semiconductor devices are not being met. Objective - to investigate the defects and impurities in silicon-on-sapphire material which reduce the radiation hardness. How research contributes - the research will contribute to the understanding of the types and concentrations of defects and impurities in silicon on sapphire and how they relate to the radiation hardness of SOS devices. The results of this research will contribute to the development of a radiation-hardened technology for use in Air Force space and missile systems.

This program will investigate the sapphire substrate and silicon film to determine defect and impurity concentrations and distributions and will characterize the effects of such imperfections on electrical and radiation hardness parameters of devices fabricated in this material. Techniques for defect studies such as X-ray diffraction, minority carrier lifetime measurements, ion backscattering, and other appropriate techniques will be investigated. Samples of silicon-on- sapphire material will be st died using these techniques to identify types of defects and impurities and their concentrations. Devices, such as MOS capacitors, will be fabricated on these samples and the radiation hardness will be correlated with the defect and impurity studies.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, N.Y.13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0003, COMMUNICATIONS - PERIODIC OPTICAL WAVEGUIDE STUDIES
S. WANG, Univ. of California, School of Engineering, *Berkeley, California* 94720 (DN223862; N00014-75-C-0420)

To provide thin-film integrated optical laser sources for integrated optical circuits to be used in Navy and Marine Corps communications and information systems. Such optical circuits offer the advantages of low weight, small size, large signal capacity, and rejection of electromagnetic interference to these systems.

Research is concentrated on experimental and theoretical work toward realizing GaAs Bragg lasers and on preferential etching of channels to provide lateral confinement via embedded heteroepitaxial technology. This research is aimed at finding new laser structures capable of precise wavelength determination, amenable to monolithic integration, and capable of lateral confinement of both the optical beam and the injection current.

ADDENDA: Supporting agency address is: Office of Naval Research 427, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0004, FUNDAMENTAL STUDIES OF CO2 LASER-PLASMA INTERACTIONS
F.F. CHEN, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (E(04-3)340236)

In laser-function, a critical problem is the coupling of laser energy to the plasma surrounding the dense core of a pellet. The extreme intensity of radiation causes nonlinear effects which can either aid or impede the absorption of energy. This project seeks to verify theoretical predictions of such effects by using CO2 laser radiation impinging not on solid targets but on independently prepared plasma targets designed to isolate the phenomena one at a time. Effects under consideration include stimulated Brillouin and Raman scattering, nonlinear mixing of two laser frequencies, and parametric instabilities at densities such that the plasma frequency is 1/2 or 1 times the laser frequency.

RESULTS: 1) Stimulated Brillouin scattering has been detected near threshold, and agreement with theory has been verified. 2) A new diagnostic has been developed for detection of ion acoustic frequencies in the plasma; this involves spectroscopic analysis of forbidden satellites of He lines.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - M.A.D.

4.0005, DESIGN AND FABRICATION OF A MAGNETIC DATA COLLECTION SYSTEM
P.J. COLEMAN, Univ. of California, Graduate School, *Los Angeles, California* 90024 (DF278550; F19628-76-C-0043)

AF function - systems for communications, guidance, navigation and detection. Deficiency - performance degrades and becomes unpredictable during severe magnetic activity. Objective - improvement and expansion of the data collection network for use in the specification and prediction of magnetic activity. How research contributes - the ability to predict magnetic activity would enable NORAD to anticipate critical periods for their systems and to exercise options for alternate methods and would minimize SAC missions that are aborted by communications problems through rescheduling or transmission mode changes.

The performance of network hardware now in use for collecting geomagnetic activity data will be reviewed and design changes made as required. Three additional fluxgate magnetometers, three digital data collection packages and a digital data acquisition station package will be constructed to the new designs.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0006, SURFACE RADIATION EFFECTS IN HGCDTE
F.A. JUNGA, Lockheed Missiles & Space Co., *Palo Alto, California* 94304 (DF900820; F19628-75-C-0127)

AF function - surveillance, detection and weapons delivery. Deficiency - operational capability of ir detector systems can be seriously affected upon exposure to nuclear radiation. Objective - determine the long-term effects of ionizing radiation on the surface properties of HgCdTe ir detectors. How research contributes - since both detector sensitivity and noise are effected by surface properties, this data is needed to assess the performance of HgCdTe ir detectors exposed to nuclear radiation. Data is also provided to develop techniques to harden these detectors to radiation.

Mwir (3 to 5 microns) and lwir (8-14 micron) HgCdTe photoconductive detectors with special metal field plates will be irradiated with cobalt-60 gamma source at 77 degrees Kelvin. Before and during irradiation as well as after post-irradiation anneals surface properties will be measured using capacitance-voltage and conductance-voltage techniques. At the same time detector performance parameters including responsivity and detectivity will be measured.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0007, MATERIAL SUPPORT TECHNOLOGY - CONTROL OF IMPURITIES IN THE EPITAXIAL GROWTH OF HIGH-QUALITY GAAS
D.A. STEVENSON, Stanford University, Center For Mat. Research, *Palo Alto, California* 94305 (DN475330; N00014-75-C-0887)

The Navy has use for gallium arsenide electronic devices in microwave communications and surveillance systems. This program will investigate the control of residual impurities and electrically active centers in the synthesis of high-purity epitaxial gallium arsenide.

The investigators will analyze the thermal-chemical reactions in a controlled growth system to determine the source of impurities, correlate the residual impurity with GaAs species, and modify the reactions accordingly. Two principal activities are to be undertaken: the development of liquid-phase epitaxial growth techniques to control impurities; and the design and construction of a molecular beam-mass analyzer system to sample, at growth temperatures and atmospheric pressure, the gaseous environment involved in the chemical transport reactions during crystal growth.

ADDENDA: Supporting agency address is: Office of Naval Research 427, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0008, HIGH-POWER MHD SYSTEM
O. SONJU, Maxwell Laboratories Inc., *San Diego, California* 92123 (DF460230; F33615-76-C-2104)

To obtain high-performance test data on a combustion MHD system. To obtain design data on an advanced MHD power system.

The program will consist of a test portion and a detailed design portion. Contractor will provide a hot gas flow train system for power testing using the AEDC MHD magnet and data system. Simultaneously, a superconducting magnet design, a power conditioning design, and a total power system integration design will be accomplished.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory POP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0009, THREE-FREQUENCY MILLIMETER-WAVELENGTH RADIOMETER
UNKNOWN, Sense Systems Company, *Temple City, California* 91780 (DF901120; F19628-76-C-0202)

AF function - improve techniques for providing tropospheric refractive bending and range error corrections for precision radar and navigation systems. Deficiency or opportunity - present methods for correcting for tropospheric refractive bending and range error assume a horizontally stratified atmosphere and rely on data collected at one surface site. For low elevation angles these methods usually fail since the ray traverses long horizontal distances and the assumption of horizontal stratification is not met. This results in unacceptable refraction corrections for low-elevation-angle tracking. Objective - design, fabricate and test a three-frequency millimeter-wavelength radiometer to be used as part of a transportable radiometer system designed to provide atmospheric emission data which has proved to improve low-elevation-angle refraction correction prediction. How research contributes - the use of atmospheric emission data at millimeter wavelengths has been found to be of value in improving the prediction of refractive bending and range error at low elevation angles. The radiometer portion of the refraction correction system has to measure atmospheric emission at 18, 22 and 35 gHz with equivalent antenna noise temperatures of near zero to three hundred degrees Kelvin. Ease of calibration, linearity and stability are the prime requirements for this unit.

ADDENDA: Supporting agency address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0010, DIGITAL FILTER DESIGN AND IMPLEMENTATION METHODS
T. BRUBAKER, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80521 (DF095390; F33615-73-C-1253)

The objectives of this program are to determine filter design and implementation techniques which are applicable to digital avionics systems, to establish the effects of word lengths and sampling rates on filter errors, to demonstrate filter implementation techniques using programmable memories with multiplexed filter controllers, and to establish filter hierarchy schemes which increase system reliability.

Using a representative set of avionic signal processing tasks, this program will examine both time domain and frequency domain synthesis approaches which have application over a broad class of filter requirements. Using programmable memories and general-purpose digital computer, and an analog computer, several candidate designs will be simulated and evaluated against program objection. A real-time demonstration will be conducted of suitable designs.

ADDENDA: Supporting agency address is: AF Avionics Laboratory AAF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0011, DEVELOPMENT OF A THREE-DIMENSIONAL COMBUSTOR FLOW ANALYSIS
H.M. MCDONALD, United Technologies Corp., *Hartford, Connecticut* 06108 (DF456880; F33615-74-C-2028)

The objective of the program is to modify and extend an existing three-dimensional Navier-Stokes calculation procedure previously developed at UARL so that it would be capable of computing combustor flows. In particular, the procedure would be extended so as to include the effects of chemistry, turbulence, radiation and two-phase flow and, in addition, the procedure would be modified to enable treatment of a realistic range of combustor geometries.

This procurement is a 29-month research and exploratory development program to develop a three-dimensional Navier-Stokes calculation procedure to enable the treatment of combustor flows. The procedure will include the effect of chemical reactions, turbulence transport, radiation energy flux and droplet vaporization and burning. It will be applicable to both can-annular and annular combustor geometries.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0012, 'DELTA K' RADAR
D.L. SCHULER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN480224)

The purpose of this work is to study the large-scale scatter properties of the ocean. The radar has been designed to obtain information on long ocean waves by detecting the spectra of the spatial variation of scattering patches. The detection performance of the radar for ship targets in sea clutter is also being studied at x and l bands.

The delta k radar transmits x-band signals at two slightly different frequencies, thus producing an amplitude-modulated waveform. The 'beat' frequency between the two signals provides an interferometric spatial signal which is used to correlate the large-scale ocean waves. Ongoing theoretical work suggests that the spectrum of sea waves can be remotely sensed by this method.

ADDENDA: Supporting agency address is: Naval Air Systems Command (310B), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0013, INVESTIGATION OF THE INTERRELATIONSHIP BETWEEN DIRECT, DIFFUSE, AND TOTAL SOLAR RADIATION
G.N. WALTON, U.S. Army, Constr. Engin. Res. Lab., *Champaign, Illinois* 61820 (DA0Q8136)

The objective is to determine a simple algorithm for decomposing total solar radiation on a horizontal surface into its direct and diffuse components.

The approach will be to collect data from three solar pyranometers, two measuring total and diffuse radiation on a horizontal surface while a third measures direct radiation, then establish from this data the algorithm for decomposing total radiation into its direct and diffuse components.

ADDENDA: Supporting agency address is: OCE Construction Engineering Research Laboratory, P.O. Box 4005, Champaign IL 61820

SUPPORTED BY U.S. Dept. of Defense - Army

4.0014, INVESTIGATION OF CONTROL AUGMENTATION AND INTEGRATED AIRCRAFT INFORMATION DISPLAYS FOR IMPROVING MANUAL CONTROL OF AIRCRAFT
S.N. ROSCOE, Univ. of Illinois, Aviation Research Laboratory, *Savoy, Illinois* 61874 (DN475251; N00014-76-C-0081)

The objective of the research is to derive improved human engineering principles for the design of aircraft control and display systems through reallocation of the manual control tasks, improvement in the dynamic relationships between control inputs and resulting aircraft responses, and improved integrated control-display functional relationships.

The central task involves systematic analysis simulator experimentation and flight tests to determine alternate methods for distributing control authority between the pilot and automated portions of the control system in order to unburden the pilot without depriving him of the minimum essential control authority.

To the extent that the pilot can be unburdened of higher order functions and inner loop control, his performance should be less variable and more precise. Investigation of control orders, improved perceptual-motor matching, and the selective application of computer aiding underlie the research approach.

ADDENDA: Supporting agency address is: Office of Naval Research, Department of the Navy, Arlington, Virginia 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0015, PROCESSOR ARCHITECTURE SIMULATION
R.T. CHIEN, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF097760; F33615-74-C-1112)

To develop the capability to simulate and evaluate different processing systems for use in future aerospace applications. By examining the processor architecture and the software requirements simultaneously, hardware/software trades can be evaluated without extensive hardware development. Hence a wide spectrum of processor systems can be examined with only the most appropriate systems developed for AF applications.

To develop the simulation hardware and software required to support processor system investigations. The processor architecture simulator would then be delivered to AFAL as a tool to allow AF personnel to investigate and evaluate processor system capabilities in response to future aerospace requirements.

ADDENDA: Supporting agency address is: AF Avionics Laboratory AAF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0016, ANTENNA LEAKAGE MODULATION PROGRAM (ALM)
G. NORTH, U.S. Army, Harry Diamond Laboratories, *Hyattsville, Maryland* 20783 (DA0F5635)

Measure modulation caused by plasma to the leakage radio frequency signal between transmit and receive antennas on a reentry missile.

Two antennas are mounted on the reentry missile and the signals received from one to the other are monitored for their amplitude and phase modulation characteristics during an actual reentry flight.

ADDENDA: Supporting agency address is: USAF Space and Missile Systems Organization, Air Force Systems Command, World Way Postal Center P.O. Box 92960, Los Angeles, CA 90009

SUPPORTED BY U.S. Dept. of Defense - Army

4.0017, DUAL-BAND ARRAY TECHNIQUE
R. LEWIS, Raytheon Company, *Bedford, Massachusetts* 01730 (DF245610; F19628-75-C-0197)

AF function - aircraft-to-satellite communication and other aircraft flush-mounted applications. Deficiency - improved antenna performance is required, particularly to achieve independent beams at widely spaced frequencies. Research - investigation of new antenna techniques for dual-band array elements. How research contributes - most present array techniques allow only one beam to be scanned at one given frequency. The several exceptions that do allow dual independent beams have relatively low aperature efficiency. New dual-band array techniques would allow lightweight arrays with efficient use of the aircraft mounting space.

The approach is to investigate the properties of a particular kind of dual-band phased array technique that used dielectric slab-loaded waveguide elements to provide separate control of two widely spaced frequencies.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LZ, L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0018, DOSIMETRY FOR TRANSIENT IONIZATION EFFECTS
E.A. BURKE, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF901670)

AF function - nuclear weapons delivery, communications. Deficiency - insufficient information is available concerning the microscopic pattern of energy deposition in electronic devices and components. As a result large errors can arise in radiation tests and vulnerability analyses. Objective - to develop the theoretical and experimental information necessary to characterize energy deposition and dose- dependent phenomena in complex structures. How research contributes - provides the basic data and theoretical models necessary for identifying, predicting, and controlling radiation-induced phenomena in electronic systems exposed to ionizing environments. In some cases uncertainties exceed a factor of ten.

Our past work has shown that one of the reasons for large dosimetry errors is a failure to allow for the microscopic pattern of energy deposition in devices. High-atomic-number materials adjacent to low- atomic-number materials in X-ray or neutron environments, and heavy ions or neutrons in any material, can produce very non-uniform energy deposition profiles. The response of electronic devices is highly sensitive to the spatial variation of primary events. Exploratory studies have shown that recent developments in microdosimetry, track structure and transport theory could be usefully applied to device structures.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0019, HARDENED DEVICES AND INTEGRATED CIRCUITS
R.P. DOLAN, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF245600)

AF function - strategic warfare, surveillance. Deficiency - electronic devices designed for commercial use do not operate satisfactorily in a radiation environment. Objective - the effect of transient ionizing dose will be studied. Charge relaxation or rapid annealing will be studied in all hardened GaTe insulator technologies. Leakage current produced by radiation at the silicon sapphire interface in SOS circuits will be investigated in both total dose and transient radiation environments. How research contributes - results to be obtained will provide design methodology for MIS devices and integrated circuits with improved radiation hardness.

MIS devices with hardened GaTe dielectrics will be irradiated in the cobalt 60 facility to determine the total dose effects on the threshold voltage of these devices. Similar devices will also be exposed to transient ionizing radiation using the linear accelerator to determine rapid annealing effects. Effects of transient ionizing radiation on microwave schottky barrier devices will be studied.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LQ, L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0020, BACKFIRE ANTENNA STUDY
H.W. EHRENSPECK, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900580)

AF function - communications. Deficiency - present aircraft antennas do not meet the directional characteristics and power handling requirements for air-to-air and air-to-satellite applications. Objective - to determine whether an array of short backfire elements can provide the basis for an antenna design with improved power handling capability sufficient for air-to-air and air-to-satellite communications. How research contributes - will provide the design methodology for an improved antenna for aircraft communications.

Introduce into the backfire cavity of a backfire antenna open-ended waveguides instead of dipoles as feeds. Pattern, gain and input impedance measurement will be performed on a single backfire antenna. Later a four-element waveguide-fed single backfire array will be constructed and tested.

ADDENDA: Supporting agency address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0021, TECHNIQUES FOR IMPROVED GAAS MICROWAVE DEVICES
D.D. EIRUG, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF254160)

AF function - solid-state device design and fabrication is relevant to Air Force missions in communications, weapons delivery and detection. Deficiency or opportunity - it is necessary to improve the performance of electronic devices in frequency, reliability, power consumption and radiation hardening so that the systems in which they are deployed will exhibit superior performance, reliability, and hardness. Objective - explore new solid-state device designs and fabrication techniques in order to improve semiconductor device performance in military environments. How research contributes - this research on device design and fabrication processes will contribute to systems that need high- frequency processing devices and power sources, such as phased-array radars.

Ions that are known to give acceptor or donor levels in Si and GaAs will be investigated in detail for physical and electrical characteristics. Determinations of implanted ion range, profile and associated damage will be made. Electrical characterization will be done via measurements of conductivity, mobility, carrier lifetime and trapping levels. In the case of GaAs, which is readily disassociated at elevated temperatures, the encapsulant that is used during the anneal becomes very important and thus becomes an additional parameter in this investigation.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LQ, L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0022, HARDENING TECHNIQUES
S.B. HERSKOVITZ, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900400)

AF function - advanced weaponry. Deficiency - laser radiation can cause damage to aerospace vehicles. Objective - to provide means of minimizing damage via measurement of laser-induced breakdown of particles and gases. How research contributes - studies effects of laser radiation on aerosol particles.

The presence of specific particles can substantially lower the laser-induced breakdown threshold of the atmosphere. Once formed, this plasma can be maintained by absorbing energy from the incident laser radiation. Work is directed toward producing aerosols which will protect surfaces from laser damage by intercepting and dissipating the incident energy.

ADDENDA: Supporting agency address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0023, STUDY OF MECHANICAL PROPERTIES OF ELECTROMAGNETIC DEVICES AND ASSOCIATED MATERIALS
J.V. NIKULA, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF901010)

AF function - communications, weaponry. Deficiency, opportunity - evaluation of mechanical criteria to electromagnetic devices and associated materials, analyzing the mechanical structure of communication devices (e.g., GaAs microwave and optical devices) and newly developed technology such as CCD's. SAW, etc. Determination of the mechanical properties of laser hardened devices and laser windows. Objective - to determine and evaluate the relationship between mechanical properties and other physical parameters. How research contributes - a method of evaluation and correlation of mechanical properties will aid in the selection of appropriate devices and materials for communications, radar, and weapons systems.

Mechanical strength studies will be performed and this data will be evaluated as a function of processing and composition parameters. The resultant evaluations will be correlated with other physical parameters to provide a meaningful working relationship between mechanical and other physical properties.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0024, TOTAL ELECTRON CONTENT AND SCINTILLATION STUDIES
P.M. HAGAN, Emmanuel College, Graduate School, *Boston, Massachusetts* 02115 (DF245980; F19628-76-C-0003)

AF function - communications and navigation. Deficiency - radio fading and timing errors. Objective - improve performance of communication and navigation systems. How research contributes -provides data for statistical models of propagation effects.

Paper chart and magnetic tape record will be analyzed to determine parameters which relate the variations in total electron content and amplitude scintillations to the degradation in performance of navigation and communication systems. The data base will include sites ranging from the auroral zone to the equatorial region and allow for the development of global models depicting the variations in TEC and scintillations.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0025, TECHNOLOGY AND PHYSICS OF INFRARED POINT-CONTACT DIODES
A. JAVAN, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF901510; F19628-74-C-0182)

AF function - surveillance, communication, reconnaissance. Deficiency or opportunity - infrared detectors are slow and need cooling. Objective - perform research and exploratory development on detection and generation of ir radiation utilizing a point-contact diode. How research contributes - the point-contact diode is a fast, room-temperature ir detector with potential applications for surveillance, communications and reconnaissance. Approach - the research will be concentrated in two main areas. Applications of the mechanically contacted junction will be explored in the areas of parametric generation and detection of infrared radiation. These studies should lead to a better understanding of the physical processes determining the diode characteristics and give information needed for the construction of a tunable infrared radiometer. The second area of research will be to investigate the possibilities offered by printed point-contact junctions and the applications of a variety of coherent phased-array configurations.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0026, WIND-TUNNEL SHOCK STUDY
M. FINSTON, Mass. Inst. of Technology, Lincoln Laboratory, *Lexington, Massachusetts* 02173 (DF247430; F19628-76-C-0185)

AF function - communication and radar survivability of Air Force systems such as the B-1, AABBCP, AWACS, BMEWS, OTH-B and DSP under naturally disturbed and nuclear environments. Objective - to determine shock wave effects on d-region ion composition measurements. How research contributes - information on shock wave position relative to the measurement probe will confirm a payload geometry for obtaining reliable d-region data which is relevant for communications and radar survivability studies.

An investigation, including wind-tunnel measurements, will be made to determine shock wave position as a function of Mach number and angle of attack to determine attached shock conditions (areas of reliable data acquisition) and detached shock conditions (isolating problem areas in data acquisition).

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK, L.G. Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0027, SUPERELLIPTICAL AERODYNAMIC FORMS
G.A. BARNARD, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0G4359)

To investigate, theoretically and then by experiment, the fluid- dynamic characteristics of blunt bodies of superelliptical cross section.

Generate a mathematical model of the two-dimensional flow about a transverse cylinder of superelliptical cross section, by conformal transformation. Calculate the viscous boundary layer. Predict the cross- flow pattern of shed vorticity. Conduct a wind-tunnel test and compare mathematical and empirical results.

ADDENDA: Supporting agency address is: NARADCOM Natick Development Center, Natick MA 01760

SUPPORTED BY U.S. Dept. of Defense - Army

4.0028, MAGNETOOPTIC DEVELOPMENT FOR LASER BEAM STEERING

T.R. JOHANSEN, Sperry Rand Corporation, *St. Paul, Minnesota* 55165 (DF100610; F33615-75-C-1099)

To fabricate and test a lab laser beam steering device designed to deflect radiation over a two-dimensional format. An 875 line raster is required at 30 frames per sec using 6328 angstrom laser radiation. An objective is at least 70 percent radiation in the deflected output beam. In addition, a random access capability is required to any point within a 20 degree deflection cone with access time of two milliseconds or less. This device will provide laser beam steering in a high-resolution television format at 6328 angstroms for the laser beam recorder. The principles used will be equally applicable at 1.06 micrometer wavelength, where a configuration might be developed to take full advantage of the random access characteristic of magnetooptic beam steering for use in the MID laser system.

Some ferromagnetic materials have been observed to exhibit faraday rotation at laser wavelengths. For example, YIG (yttrium iron garnet) is usable from 0.5 to 8.0 micrometers where optical absorption is not excessive. Other materials are useful at visible wavelengths. When crystals of these materials are grown to a critical thickness (on the order of 1000 angstroms) a type of magnetic domain structure descriptively called stripe domains will appear with magnetization of adjacent domains alternately pointing upward and downward out of the film plane. This critical thickness depends on the many parameters of the deposition process and substrate characteristics. Stripe domains display a nearly perfect periodicity ranging from 1000 to 40,000 angstroms. When polarized light is incident on a stripe domain film, the polarization of light passing through domains with magnetization in one direction will be rotated in one direction while light passing through adjacent stripes will be rotated in the opposite direction. The result is a many slit transmissive diffraction grating. The first order spots can then be deflected by changing the domain spacing and orientation with external magnetic fields. This effort will use transmissive materials in a double-pass configuration as this has been shown to be the most efficient mode of operation.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHO, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0029, SURVEILLANCE - LASER CRYSTAL GROWTH

R.F. BELT, Litton Precision Products Inc., *Morris Plains, New Jersey* 07950 (DN123025; N00014-76-C-0770)

Blue-green lasers are needed for underwater imaging, communication, and surveillance. In addition, the Army and Marine Corps are interested in the 2 micron laser as eye-safe rangefinders and designators.

This contractor will grow high-purity ylf crystals of various dopings for testing by Ft. Monmouth. Trivalent cerium, divalent europium, or divalent ytterbium will be used as activators for broad- band, blue-green fluorescent crystals. Powder samples will first be prepared to test spectra and single crystals of the most promising will be supplied to W. Yen for testing at the Unviersity of Wisconsin.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0030, NUMERICAL SUPERSONIC FLOW FIELD STUDIES FOR NAVAL AIRCRAFT AND MISSILES

S.I. CHENG, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DN123280; N00014-75-C-0376)

The development of accurate methods to compute the flow fields about wings and bodies for complex flow situations is essential for the aerodynamic design of aircraft and missiles. In the proposed investigation, the flow over a yawed cone and the interaction of a shock wave with a boundary layer will be studied within the framework of the Navier-Stokes equations. The cone problem is representative of the flow over the forward portion of a maneuvering missile or aircraft and the shock wave study is representative of transonic flow on an airplane wing.

Many complex flow situations about aircraft and missiles cannot be calculated with reliability by existing theory. Developments in computer technology together with advances in numerical methodologies now make the study of these complicated flows, within the framework of the fundamental equations of motion, an extremely attractive and fruitful approach. Major emphasis will initially be on the shock-boundary layer interaction problem. Both laminar and turbulent boundary layers will be treated; a phenomenological model will be used to describe the turbulent layer.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0031, SLED TEST SLED RUN SUPPORT

E.E. PETERSON, U.S. Air Force, Test Track Division, *Holloman Air Force Base, New Mexico* 88330 (DF418095)

Development of instrumentation and test methods required for payload testing above 50 g's, development of slow speed pusher (50-100 ft/sec) to provide smooth acceleration and long duration constant velocity for calibration of many sleds prior to full-scale test, improving the best estimate of accuracy of 0.004 ft/sec to 0.001 ft/sec as required for evaluation of advanced inertial guidance systems and validation of previously untested types of instrumentation and equipment.

Obtain the Track Division's support in performing R&D testing on the high-speed test track.

ADDENDA: Supporting agency address is: 6585TG/Guidance Test Division, Holloman AFB, NM 88330

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0032, PROTOTYPE CEILING AND VISIBILITY SENSOR

R.S. BONNER, U.S. Army, Atmospheric Sciences Lab., *Las Cruces, New Mexico* 88002 (DA0D2293)

To provide a portable, low-cost remote ceiling and visibility sensor to support US Army low flying, close support fixed and rotary wind aircraft and artillery operations.

Design and fabricate an experimental development model portable ceiling and visibility sensor using lidar technology and evaluate its capability.

ADDENDA: Supporting agency address is: ECOM Atmospheric Sciences Laboratory, (DRSEL-BL-D), White Sands MR, NM 88002

SUPPORTED BY U.S. Dept. of Defense - Army

4.0033, NAVY VEHICLE DESIGN AND CONSTRUCTION - UNSTEADY VISCOUS FLOWS

J.G. HALL, State University of New York, School of Engin. & Appl. Sci., *Buffalo, New York* 14214 (DN223404; N00014-76-C-0057)

Unsteady viscous flows which occur, for example, on aircraft wings during buffeting and stall, and in aircraft propulsion systems seriously affect performance throughout the speed range. Current viscous flow research has been overwhelmingly concerned with steady flows. It is the purpose of the proposed research to study, experimentally and theoretically, unsteady laminar and turbulent boundary layers over a broad range of Reynolds numbers in a tube-type wind tunnel at low speeds.

The use of a short duration tube-type wind tunnel is a simple yet powerful method for the experimental study of unsteady viscous flows. An extremely reproducible viscous flow will be generated either on the walls of the tube or on a model supported in the tube. Though the flow will last for only milliseconds, it will be long enough for detailed measurements utilizing pressure and

skin friction gages, resistance thermometers, pitot probes, and hot-film and hot-wire probes. Laminar and turbulent boundary layers will be studied with reynolds numbers ranging up to full scale. Major emphasis will be devoted to the study of turbulent boundary layers, including comparisons of the experimental results with integral methods for prediction. The relaxation of the time-dependent flow to steady state will be followed.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0034, EVALUATION OF ACOUSTIC EMISSION FROM REVERSIBLE ACOUSTIC STRESSES USING PHASE-SENSITIVE METHODS 10350

D.N. BESHERS, Columbia University, School of Mines, *New York, New York* 10027 (DA0D8933; DAHC04-74-G-0118)

To evaluate the acoustic emissions generated during processes of plastic deformation and fracture through employment of well-established techniques for processing of signals, in particular, the method of phase-sensitive detection. Relevance - a wide range of practical extensions of the proposed research exist in the field of non- destructive testing. Of greatest significance is the possibility of detecting incipient cracks in munitions, in armament, and in critical sections of aircraft that are susceptible to damage in fatigue.

Emphasis is to be placed upon the region of low-level emissions, especially those produced under repeated loads, in attempts to correlate such emissions with movement of dislocations, with features of microstructure, and with mechanical properties of materials ranging from yield stress and variation of flow stress with strain-rate and temperature through fatigue behavior.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0035, COELOSTAT TRACKING SIMULATOR PROGRAM

R.F. OGRODNIK, U.S. Air Force, Rome Air Development Ctr., *Rome, New York* 13442 (DF741610)

To develop and test a pointing and tracking algorithm which will generate the required update command logic and predictive filter models for smooth target tracking. To aid this effort, a computer simulation of the Coral tracking system will be developed and will encompass the functional interplay of the coelostat beam director, transmitter and receiver optical channels, and the passive active optical sensors employed by this system.

Math models and data flow algorithms will be developed from known mechanical properties of the coelostat mount, position and rate command servos and the optical channel transfer function. The latter will contain transmitter/receiver field zoom and squint angle control capabilities. Modelling for the optical sensors will include photon- generated shot noise effects on sensitivity due to target background for the case of the passive sensors, and the induced optical oscillator noise effects for the active sensors. These models will be included as subroutines in the overall tracking simulator program. Simulation studies will include laser tracking missions for both satellites and high-flying aircraft from the acquisition phase to fine track phase. Factors which will be varied for analytical purposes will be state vector uncertainties, systematic error model compensation efficiencies, and predictive filter modelling formats.

ADDENDA: Supporting agency address is: Rome Air Development Center OCT, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0036, RESEARCH ON INVESTIGATION OF THE BOUNDARY LAYER BEHAVIOR ON TURBINE AIRFOILS

L.S. HAN, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF451660; F33615-75-C-2052)

This is a 24-month exploratory, experimental and analytical program to determine the influence of upstream airfoil wakes on the transition behavior of the turbine airfoil boundary layer and to develop an analytical method of prediction of wake velocity profiles at various positions downstream of the trailing edge.

A necessary step in the development of cooling technology of rotor blades is to experimentally ascertain the combined influence of upstream wakes, high levels of turbulence, pressure gradients and surface curvature on the initiation and development of transition in the boundary layer. The ground work for this study has been developed under Contract F33615-75-C-2033 and provides data on the effect of wakes from an upstream cascade on the flow around and behind a cascade of turbine airfoils in terms of pressure profile changes and shifts in the velocity profiles of the airfoils' wakes. Detailed experimental investigation of the transition regions' locations and characteristics, as well as an accurate knowledge of the stator wake and free-stream turbulence characteristics, are now necessary to determine the relative influence of the relevant factors on the boundary-layer development.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0037, A HIGH-POWER ELECTRON BEAM GENERATOR FOR FLOW VISUALIZATION AS APPLIED TO MILITARY VEHICLES TESTED IN HYPERSONIC FACILITIES

D.V. BREITENBECHER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF131160)

Ground test facilities such as the High-Temperature Facility (HTF) are used for the development of new military flight vehicles and to advance theoretical techniques for flight performance predictions. Operational testing in ground facilities is essential to prevent technological design deficiencies of advanced ballistic missiles and manned reentry vehicle concepts. The flow and aerothermodynamic characteristics in the facility test section must be known to accurately correlate facility data with free-flight performance. The object of this work unit is to modify a commercial direct-emission electron gun and develop the associated beam transport system so the flow patterns around the models can be visually observed during facility operation. The work unit has been enlarged to include the fabrication and installation of the electron gun into the High-Temperature Facility.

Modification of an existing electron gun system will lower the design costs as opposed to a new development program. The gun is a standard component being originally designed for an electron beam welder operating in a high-vacuum atmosphere. The major technical problem is to design an aperture and gun to be capable of maintaining a suitable vacuum in the gun chamber while permitting a maximum beam current through the facility test section. The beam handling equipment, focusing and steering, must be designed to operate in the test chamber under the influence of strong magnetic fields and at low-pressure and high- temperature conditions.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXN, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0038, DEVELOPMENT OF THERMOCHEMICAL DIAGNOSTICS IN THE BOUNDARY LAYER OF AN ARC-HEATED FLOW FOR TESTING REENTRY VEHICLES

R.F. CARPENTER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF130210)

The design of missiles and high-speed flight vehicles requires the prediction of flow patterns around the vehicles. To avoid technological difficulties models of the vehicles are tested in arc-heated ground simulation facilities such as the AFFDL 50 megawatt hypersonic test leg which allow the demonstration of the feasibility of the new technology to provide performance improvement and cost reduction. A knowledge of the thermal and chemical state of the flow in the facility, both in the core and the boundary layer, is necessary to formulate and confirm theories of the energy transfer upon flow patterns. The object of this work unit is to study the temperatures and concentrations of species in the boundary layer of this unique facility since the boundary layer is thick enough to obtain a detailed profile.

Studies will be made with high-current electron beam excitation and the emitted spectra will be examined with spectrometers to obtain the rotational and vibrational temperatures of nitrogen and the species concentration of nitrogen in the boundary layer and core of the flow.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXNC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0039, TURBINE AIRFOIL BOUNDARY-LAYER SEPARATION AND REATTACHMENT
L.L. DEBRUDGE, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF456400)

To analytically develop a separated flow model to be compared with the experimental observations of G.J. Walker of separated laminar flow on axial compressor blading. This analytical effort is a follow-on to the work performed under in-house project AFAPL-3066-06-21.

The potential flow configuration, featuring a circular cylinder with circulation in cross flow and two equal but opposite vortices at rest behind the cylinder, will be modified to include a space distribution of vortex filaments of appropriate strength. This configuration will be degenerated into a Joukowski airfoil with a separation bubble generated by the vortices correspondingly transformed. The transformed configuration, thus obtained, should be an accurate representation of the separated laminar flow experimentally studied by G.J. Walker, 'Observations of Separated Laminar Flow on Axial Compressor Blading'. Once the potential velocity flow field on the wall of the compressor blade has been obtained, the development of the separated mixing layer into laminar, transitional and turbulent stages will be attempted. Caiculation of flow losses in a two-dimensional cascade when separation occurs will be attempted and the results obtained compared with experimental data.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0040, RESEARCH IN HIGH-SPEED REACTING FLOW PHENOMENA
J.E. DREWRY, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458790)

AF function - advanced aerospace vehicles, propulsion, and weapon systems. Deficiency - need for improved supersonic diffusers for air- breathing engine inlets and high-energy lasers. Need for lower drag projectiles for armament. Research - studies of two- and three- dimensional shock wave-turbulent boundary layer interactions. Studies of effects of boattailing and base blowing on aft-body drag. How research contributes - knowledge for design of more efficient supersonic inlets and laser diffusers, and for design of low drag projectiles.

Experimental studies on projectile model in AFFDL Mach 3 high- Reynolds-number facility. Experimental studies of wedge-induced three- dimensional shock waves impinging on the sidewall turbulent boundary layer in the AFAPL Mach 3 flow channel. Review of three-dimensional shock-boundary layer interactions.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory RJT, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0041, VISCOUS AND INTERACTING FLOW FIELDS ABOUT FLIGHT VEHICLES
A.W. FIORE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF138520)

The problem is to improve the technical base in order to predict pure turbulent boundary layers and viscous interactions so that such items as pressure distribution, local velocity profiles, skin friction, and heat transfer on military aircraft and maneuvering reentry nose cones can be predetermined. The technical objective is to generate fundamental data on the characteristics of high-speed viscous and interacting flow fields about vehicles at Reynolds numbers sufficiently high so that transitional and turbulent boundary layers are present. The resulting data will make possible the prediction of separated flow fields for aircraft flying at high angles of attack.

The approach to solving these problems will be experimental efforts to gain knowledge of both two - and three-dimensional viscous and interacting flow fields. The emphasis will be on (a) transitional and pure turbulent boundary layers, (b) turbulent viscous-inviscid interacting flow fields, (c) the application of boundary layer control for the purpose of reattaching separated flows at very high angles of attack as well as decreasing the overall drag of the flight vehicles, and (d) shock-boundary layer interactions. These studies will include various types of pressure gradients, surface roughness, and wall temperature parameters. Tests will be conducted at speeds extending from transonic to hypersonic Mach numbers.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXEC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0042, REAL-TIME OPTICAL PROCESSING CONCEPTS
D.L. FLANNERY, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF097390)

To realize the potentials of optically parallel processing large amounts of data in real time with the temporal bandwidth, number of resolution elements and other parameters which are desired for real-time optical processing of wideband signals. To demonstrate the type of processing system capability afforded by real-time modulator technology and to perform design studies of systems oriented toward processing the type of signals of interest to potential users. To formulate and demonstrate concepts for real-time image analysis by parallel processing electronic signals at television data rates using optical processing needs for target detection and recognition such as real-time incoherent image converter, real-time Fourier plane filter, and variable scanning aperture.

To analyze the requirements, design the appropriate in-house demonstration system using a thermoplastic real-time modulator to process wideband temporal signals, and evaluate its performance in the laboratory. To provide the optical systems for testing and analyzing such devices as the thermoplastic modulator, electronically addressed Fourier plane filter, electronically addressed scanning aperture, and incoherent-to-coherent image converter in the overall system concept.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0043, SPHERICAL NEAR-FIELD INSTRUMENTATION AND SOFTWARE STUDY
K.R. GRIMM, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF099180)

The objective of this in-house investigation is to devise antenna probe positioner designs appropriate to the near-field sampling of advanced airborne apertures. Useful positioner designs will readily lend themselves for incorporation into the improved anechoic chamber in Building 821. Simultaneously, the in-house effort will be expended to modify digital computer field transformation software, recently available from contractual exploratory programs, for use in supporting the to-be-defined positioner hardware. A corollary objective will be to investigate the utility of the transformation algorithms with data measured on existing far-field ranges for apertures whose far-field criteria exceed the separation distances available in the anechoic chamber.

Positioner designs will initially concentrate on configuration studies using the existing free space range 16 ft model 5872-R tower and its azimuth/elevation 5330B positioner. Probe fixtures appropriate to the transmit or receive function for apertures mounted on the model tower will be considered. Effort will also be directed to modifications to the TAPA (three-dimensional antenna pattern analyzer) ground plane range for use as a spherically scanning near-field range. The initial problem will be to study the impact on elevation probing when the aperture to be evaluated cannot be flush mounted to the TAPA ground plane. A third possible approach will be to develop a completely independent positioner which may take advantage of multiplanar surface sampling, or cylindrical, or spherical surface sampling, or some hybrid combination thereof. Such a fixture will probably replace the TAPA range. The fabrication of such a range will be a con-

tractual effort, but the design detail and chamber integration specifications will be provided by this in-house work unit.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0044, CONTROL OF OXIDES OF NITROGEN FROM THE DISCHARGE OF ELECTRIC ARC-HEATED AERODYNAMIC TEST FACILITIES

P.R. PITTS, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF130310)

To identify and alleviate technological deficiencies, high-speed flight vehicles must be tested under the conditions encountered during reentry into the earth's atmosphere. Heating studies and tests, which can reduce acquisition costs, are conducted for Samso and others on aerothermal structures and protection systems in ground test facilities such as the AFFDL HTF, EGF and 50 megawatt facilities at lower production and operating cost than by extensive operational testing. In these simulation facilities, as in free flight, the air about the model is dissociated and oxides of nitrogen (nox) are formed. The facility effluent is exhausted to the atmosphere where the nox contributes to the local air pollution. The objective of this work unit is to develop the technology, techniques and hardware to treat the noxious components and render the facility effluent innocuous, and to refine the instrumentation and techniques used to measure and control the nox effluents. Control of nox makes possible the continued use of the simulation facilities in overcoming the technological deficiencies of the high-speed flight vehicles.

The efficiency of the existing, in-house developed, absorbtion scrubbing technique will be evaluated. Analysis and extensive realistic operational testing will be conducted to demonstrate the practicability of new technologies to contribute to operating cost reduction and scrubber performance improvement. Apparatus will be developed to insure the reliability of existing instrumentation. Instrumentation will be developed to verify stack discharge emission limit compliance when said limits are established by others.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXND, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0045, COMPUTER-AIDED DESIGN FOR MICROELECTRONICS

R.L. RAY, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF101260)

Advanced avionics subsystems require highly complex and ultra- reliable circuitry. The objective of this work unit is to provide the in-house expertise in computer-aided design necessary to capitalize on sophisticated computer techniques used in the analysis, simulation, and fabrication support of electronic circuits. Short-term goals are capabilities for automatic route- and-fold of conductor paths, test fault analysis, thermal analysis, and cost- reliability modeling. The long-term goal is to provide an outstanding in-house capability in computer-aided design and thus impact in-house developments by decreasing the design cost and the design time, increasing the confidence level of a design and its reliability, and standardizing the maintenance concepts which are built into new designs.

An in-house center of excellence in the computer-aided design of electronic circuits will be established. Cad tools, such as interactive analysis and simulation down to the gate level, will be provided for the design of complex microelectronic circuitry. Furthermore, the capability to generate computer outputs in forms directly usable for fabrication, test, and evaluation of production circuits will be available. Approximately equal emphasis will be placed on computer-aided analysis and computer-aided graphics. The in-house expertise will thus allow a more effective interface with user organizations and industry.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0046, AVIONICS EVALUATION PROGRAM

D.E. SUMMERS, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF098030)

Perform in-house analyses of air-to-ground weapon system concepts utilizing a computerized model. The analyses quantitatively assess the impact of avionic reliability, subsystem performance and system survivability on mission effectiveness. Sensitivity and trade-off analyses performed under this effort will provide performance data to engineers involved in concept synthesis and analysis.

Utilize the avionics evaluation program (AEP) to perform tradeoff and sensitivity analyses. The AEP is an air-to-ground mission effectiveness model which has been implemented in a conversational interactive graphics mode. Data generated using the AEP include: number of targets killed, targets acquired, a/c lost and mission aborts, avionic utilization data, avionic black box failures, subsystem performance data and weapon delivery error sensitivities.

ADDENDA: Supporting agency address is: AF Avionics Laboratory AAA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0047, EXPERIMENTAL RESEARCH ON FLUID DYNAMIC ENERGY CONVERSION AND TRANSFER PROCESSES

R. GRIFFITH, Univ. Energy Systems Inc., *Medway, Ohio* 45341 (DF136500; F33615-73-C-4053)

In the area of aerospace propulsion and electromagnetic weapons, efficient large-capacity low-pressure vacuum pumping and high-pressure recovery compact internal fluid dynamic supersonic diffusers are required. Research on turbulent mixing, multicomponent flow processes and supersonic diffusers provides new knowledge relevant to improving energy conversion and transfer concepts for advanced propulsion and electromagnetic weapons systems. Multicomponent flow studies are directed at the demonstration of a capability to develop a useful low- pressure vacuum pump using multicomponent processes. Energy transfer studies are directed at enhancing the mixing of multiple streams through unconventional turbulent means. Laser diffuser studies are directed at providing compact, lightweight supersonic diffusers for gas dynamic and radial outflow chemical lasers.

Primarily through experimental means, provide data extending the state-of-the-art in multicomponent flows and fluid dynamic energy transfer. Specifically, provide data on the (1) processes involved in the use of multicomponent flow for high-volume, low-pressure vacuum pumping, (2) use of novel concepts for internal fluid dynamic supersonic diffusers, (3) application of fluidically controlled self-oscillating nozzle flows for enchanced mixing.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXEC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0048, FRACTURE MECHANICS & CRACK PROPAGATION HYPOTHESES FOR NAVAL AIRCRAFT STRUCTURES

P.A. KOZEL, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN133126)

Evolve engineering hypotheses for use in determining residual strength, fracture resistance and crack growth behavior in structures as means of ensuring structural integrity of naval aircraft.

Analytical and experimental work will be performed to investigate the influence of parameters such as material thickness and width, crack length, and mean and alternating stress on residual strength and crack growth in metallic structures. Program results will be used to develop fracture and crack growth models suitable for automated application in predicting the safe life and residual strength of an aircraft structure. Related studies into the fundamental nature of fracture and crack growth will be performed. Some of this work is being performed under contract at Battelle Columbus Labs, as reported in work units DG 602-B5 and B6.

ADDENDA: Supporting agency address is: Naval Air Systems Command (320b), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0049, STUDY OF THE IONOSPHERE USING TRANSMISSIONS FROM RADIATING SATELLITES
S.J. CARDUS, Ebro Observatory, *Tortosa, Spain* (DF258020; AFAFOSR-2745-75)

AF function - navigation. Deficiency - refraction and pulse delay errors. Research - measures ionospheric parameters related to solar activity. How research contributes - results combined to construct TEC model used in calibration of global navigation systems in the European sector. This work continues TEC observation using INTELSAT II F3 and data reduction in the Joint Satellite Studies Group format. Objective - to determine destructive effects of travelling ionospheric disturbances on radio and radar signals.

Using a vhf polarimeter supplied by AFCRL, the grantee will observe faraday rotation in the ionosphere in order to derive total electron content values on a continuous basis. These reduced data will be supplied to AFCRL in standard format, in addition to furnishing the basis of the grantee's own scientific analyses and reports.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, L.G. Hanscom AFB, Bedford, Mass 01730. Performing organization: Observatorio del Ebro, Tortosa, Spain.

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0050, SURVEILLANCE - SYNTACTIC PATTERN RECOGNITION SYSTEM
R.C. GONZALEZ, Univ. of Tennessee, School of Engineering, *Knoxville, Tennessee* 37916 (DN475122; N00014-75-C-0545)

The goal is to achieve a means for automatically and rapidly recognizing the presence and type of a target of military interest in the field of view of pictorial imagery as derived from TV or FLIR sensors, aerial photography, etc. Such capability could be adapted to serve a robotic function to expand the mission potential of unmanned aircraft.

The syntactic approach to pattern recognition here undertaken utilized mathematical models of grammars which are teachable to computers for recognition-problem-solving using human-specified features such as loops, number of strokes, or bays. This approach to be explored is the development of learning algorithms which use a set of primitive structures in the recognition process. A key approach is to initially incorporate a trained human operator into the learning loop to test, speed, and refine the development of these algorithms. Once the algorithms have been thus perfected, the pattern recognition system will operate automatically without human assistance.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0051, DEVELOPMENT TESTS OF CRL GAGES
W.B. STEPHENSON, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF420825; F40600-75-C-0001)

This project is for work on instrumentation for atmosphere sampling in cooperation with the Air Force Cambridge Research Laboratory. AFCRL is engaged in the development and operation of rocket and satellite- carried sampling instruments.

The AEDC work will be directed toward methods of analysis of high- altitude exhaust plumes and in the development of high-energy, low- density gas-dynamic test facilities.

ADDENDA: Supporting agency address is: Arnold Engineering Development Center, Arnold AFB, TN 37389

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0052, LASER, HOLOGRAPHIC AND OPTICAL SYSTEMS
A.A. DOUGAL, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

DESCRIPTION: This research is concerned with analytical and experimental studies of laser, holographic, and optical systems and applications of such systems. We are concentrating on two principal topics, the first involving coding and decoding of information in incoherent radiation, and the second concerning picosecond optical systems and their applications in measuring ultrafast physical phenomena.

In many important applications of incoherent optics such as photography, microscopy and X-ray imaging, the information is recorded in a coded format. A blurred photograph or an aperture coded X-ray image are examples. These images may not contain much useful information as far as the eye is concerned. However, by using optical or digital filtering techniques it is possible in certain cases to deblur or decode these things. The decoded image is usually one that is more informative to the eye. We investigate techniques for decoding images which have been coded in incoherent radiation. Mode-locking of most types of lasers has now been demonstrated and, for the most part, is fairly well understood. The resulting trains of ultrashort optical pulses on this previously unavailable time scale are convenient for making time-resolved measurements. Our project uses single picosecond pulses from a simultaneously Q-switched and mode-locked Nd:YAG laser to make time-resolved measurements on fast processes with relatively high energy thresholds, in particular, the semiconducting-metallic phase transition in vanadium dioxide. We are measuring instantaneous electron populations and conductivities of vanadium dioxide as it undergoes the phase transition, utilizing an optical delay line system.

SUPPORTED BY University of Texas

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, MEASUREMENT AND ANALYSIS TECHNIQUES FOR MANAGEMENT PLANNING
E.L. AMIDON, U.S. Dept. of Agriculture, Pac. S.W. For. & Rg. Exp. Sta., *Berkeley, California* 94701 (0000088; PSW-1301)

OBJECTIVE: Devise systems for providing forest managers with static inventory and dynamic biological response information needed for decision-making. Emphasis is placed on the mensurational problems associated with estimating wood product growth and yield.

APPROACH: Full use will be made of photogrammetry and associated scanning, digitizing, and computing techniques to determine the location of management problems and opportunities. Techniques for making stand- growth projections will be developed starting with tree-growth models. Techniques will be developed to provide advanced inventory-estimating systems such as multi-stage probability sampling and the combined use of remote sensing and modern field measuring techniques.

PROGRESS: The primary research area was the development of geographical information systems for wildland resources. The Wildland Resource Information System (WRIS) was used for the Stanislaus, Eldorado, and Sierra National Forest timber inventories. Development and application was a joint effort between the Branch of Management Plans and Inventories, Region 5, and the Timber Measurement and Analysis Project, PSW. Timber inventory work involved variable probability sampling, a mapping system, and growth projection. The information acquired was used to calculate the allowable cut on the Stanislaus and Eldorado National Forests via the RAM model. The acquisition of in- place information on the Sequoia, San Bernardino, Inyo, and Six Rivers National Forests will be completed in 1976. Continual extensions will be made to the mapping system following acceptance testing of a new, high-speed scanning microdensitometer. Benchmark tests by the Management Science Staff, Berkeley, showed decreased operating costs due to system modifications since publication. Tree and stand growth parameters will be collected for input to a growth model.

SUPPORTED BY U.S. Dept. of Agriculture - F.S.

5.0002, DOPPLER ACOUSTIC RADAR FOR OPERATIONAL MONITORING OF WIND SHEAR AT AIRPORTS
UNKNOWN, Aerovironment Incorporated, *Pasadena, California* 91105 (TS59019; TSC-1158)

OBJECTIVES ARE: 1. Adapt one (1) AeroVironment Model 3020 Acoustic Sounder to record the backscattered acoustic signal to a range of 1000 ft. 2. Install acoustic sensor at

Logan Airport at a location to be designated by the DOT/TSC Technical Monitor. Construct an acoustic enclosure for the receiving unit. 3. Operate and maintain equipment for one month. Collect and record all data necessary to evaluate the acoustic signal return.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec. -

5.0003, STORM PRESSURE CHANGES
A.R. JORDAN, Unknown Inst. or Indiv. Grant, *Colorado* (DN323014; N00014-73-C-0320)

The objective of this research is to use sensitive pressure measuring equipment to identify gust thresholds hazardous to aircraft landing and takeoff and, additionally, attempt to make specific identification of the pressure pulse of a thunderstorm so that the identification might be used for greater safety of naval operations sensitive to electric field transients.

Data on gusts, pressure pulses and associated waves obtained by means of anemometry and pressure sensors will be analyzed to obtain characteristics of various storm situations and phase.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0004, LEAD AS AN INDICATOR OF ENVIRONMENTAL QUALITY IN AIRPORT ENVIRONS
C.E. THALKEN, U.S. Air Force, Chemistry & Biol. Sci. Dept., *Colorado Springs, Colorado* 80840 (DF281680)

AF function - environmental support of base operations (environmental impact of aircraft operations). Deficiency - no data are available on the concentrations, accumulation rates, or effects of many aircraft-generated pollutants in the environs in and around military installations and air strips. Specifically, there is no data available on the build-up of lead in the air installation compatibility use zone (AICUZ). Build-up of lead and other toxic compounds is under close scrutiny by the EPA and their standards are becoming increasingly more stringent. These standards will limit the boundaries of AICUZ's and limit their industrial and agricultural use. Research - techniques will be developed for assaying lead concentrations in the soil, fauna, and flora of the AICUZ of Peterson Field, Colorado Springs, Colo. Data obtained will be correlated to uncontaminated areas (control) to a highly contaminated fossil-fuel-burning power plant area, and to all available EPA standards. How research contributes - techniques developed will allow evaluation of aircraft-generated lead pollution on USAF installations. Data generated from the Peterson Field environ will allow evaluation of possible health problems from lead contamination in and around AICUZ. Extrapolation of the data can be used to predict lead concentrations on other USAF installations to predict the effects of lead accumulation in the future, and as a management tool for environmental planning.

ADDENDA: Supporting agency address is: Frank J. Seiler Research Lab NC, USAF Academy, Colorado 80840

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0005, MESOSCALE VARIATIONS OF THE RADIATION BUDGET
M.A. ATWATER, Center For Environ. & Man Inc., *Hartford, Connecticut* 06120 (ATM76-09581)

The specific objectives of this research are: (1) to modify and refine the radiation model developed at the Center for the Environment and Man; (2) to test the refined models using a unique and detailed data sample obtained during the International Field Year of the Great Lakes which included frequent and densely spaced rawinsonde data; (3) to generalize the numerical models to simulate mesoscale variations of radiative fluxes; and (4) to obtain refined mesoscale variations in year-long radiative fluxes over the Lake Ontario basin.

The major results will define quantitatively, for the first time, the fields of variation of all radiative fluxes over a year-long period, with horizontal resolution about 20km within a region of 50,000 km2 area. The region to be simulated in this project is characterized by the large intra-regional and intra-annual variability of weather and climate typical of the mid-latitude Great Lakes.

Successful completion of this project will demonstrate the accuracy desired in the observations and the expected mesoscale variations of the radiative fluxes for regions of this type.

SUPPORTED BY U.S. Natl. Science Foundation

5.0006, APPLICATIONS OF ACOUSTIC PROBING TO PROBLEMS OF ATMOSPHERIC TRANSPORT
E.L. MILLER, Argonne National Laboratory, *Argonne, Illinois* 60439

Assessments of the regional atmospheric environmental impacts of power production installations and other large-scale energy conversion facilities require an improved understanding of mesoscale atmospheric dispersal processes. In particular, there is need for additional information on the manner in which these circulations are affected by various types of terrain and changing synoptic meteorological situations. This program uses acoustic remote-probing techniques to observe over mesoscale distances. Acoustic sounder data recorded simultaneously at several locations are being interpreted along with standard meteorological and air-quality measurements to quantify the effects of terrain variation and changing meteorological conditions on dispersion in the lower atmosphere. Results obtained will contribute to the development of improved atmospheric models for regional air-quality assessment.

RESULTS: Simultaneous acoustic sounder observations of boundary layer structure over rural, residential and urban terrain in the St. Louis and Chicago metropolitan areas reveal that systematically greater inversion heights toward the city center and significant differences in structure within the stable nocturnal boundary balloon-tracking system are improving the interpretations of the acoustic sounder records.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - B.E.R.D.

5.0007, AIRBORNE MAGNETOMETER STUDIES
H.L. YARGER, State Geol. Survey, *Lawrence, Kansas* 66044 (KGS-117)

DESCRIPTION: The study of structure and faults in deeply igneous rocks may identify areas of potential hydrocarbon accumulation in overlying rocks. This work also may lead to identification of areas of possible mineralization. The magnetic character of igneous rocks permits a relatively fast and economical method of study of deeply buried structures through mapping of small changes in the earth's magnetic field by the airborne magnetometer. The program includes data acquisition at a rate of approximately 20,000 line-miles per year, generation of machine-contoured maps at a 1:125,000 scale, development of computer programs for interpretation analysis, interpretation of data for geologic meaning, using both standard and computer-aided techniques, and magnetic susceptibility measurements on wall cuttings and cores for use in interpretation of magnetic data. This program will be funded, in part, by the U.S. Geological Survey.

ADDENDA: Estimated calendar year funding reported as 1975 $12,306.

SUPPORTED BY Kansas State Government - Topeka

5.0008, RESEARCH IN ATMOSPHERIC SCIENCES/ATMOSPHERIC IONIZATION/COSMEP COMPOSITION MEASUREMENTS
G.E. KELLER, U.S. Army, Ballistic Research Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0H4454)

As part of the Combined Stratospheric Measuring Program (COSMEP), the concentrations of atmospheric minor constituents, both ions and neutrals, and the relevant meteorological factors are to be measured directly and nearly simultaneously. Knowledge of the atmospheric environment is necessary to the development of weapons systems and communication systems that are required to operate in and through the atmosphere. Section 9 of the Army Qualitative Research Requirements for Nuclear Weapons Effects (QRR) documents the requirements for this research.

Infrared emission and/or absorption measurements made with balloon- borne sensors will be utilized to determine at-

mospheric profiles for the minor neutral constituents; mass spectrometers on balloon-borne packages will be utilized to measure positive ions, negative ions, and neutrals in the stratosphere. Relevant meteorological measurements will be made. The data obtained by the various sensors will be analyzed. Sensors and techniques that can better quantify the atmospheric environment will be developed and evaluated.

ADDENDA: Supporting agency address is: DARCOM Ballistic Rsch Labs, Aberdeen PG MD 21005

SUPPORTED BY U.S. Dept. of Defense - Army

5.0009, STRATOSPHERIC MEASUREMENTS OF PARTICULATES
H.A. MIRANDA, Epsilon Laboratories Inc., *Bedford, Massachusetts* (DF246860; F19628-76-C-0104)

AF function - reconnaissance, communications, surveillance, guidance, target acquisition and tracking. Deficiency - the performance of optical systems observing through the atmosphere is significantly degraded by light scattering and absorption and is a variable complex function of the atmosphere in the theatre of operation. Research - balloon measurements of atmospheric haze particle concentration and size up to 30 km altitude. How research contributes - these experiments will provide direct measurements of atmospheric input parameters for computer programs utilized for the prediction and analysis of atmospheric optical effects on various optical and electrooptical systems under operational use. Novel devices have been designed, fabricated, and flown to measure the size distribution and concentration of haze particles from ground level to 30 km altitude. Results from these flights will provide direct input data needed for evaluating the accuracy of theoretical computational methods on light transport. Such theoretical programs are important for the calculation of atmospheric optical effects on specific electrooptical systems under given operating conditions.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory OP, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0010, AEROSOL COMPOSITION
G.T. BEST, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF244800)

AF function - environmental impact statements of high-altitude Air Force operations. Deficiency - current or anticipated Air Force operations in the stratosphere may deposit aerosols which could be harmful to the environment. Research - study the spatial locations, size distribution, chemical composition and variation therein, of stratospheric aerosols. How research contributes - aerosols play a dominant role as a sink mechanism for many atmospheric species. Determination and distribution of aerosols permit estimates of stratospheric composition and possible perturbations introduced by aircraft and missile exhausts.

There are two basic techniques for aerosol particle collection, which may be further sub-divided. (a) Filtration. Previous work involving filters has been used fiber-type filters whose pore size is somewhat irregular and whose structure is such that trapped particles are not always accessible to electron microscope beams. A recently developed membrane filter has the virtues of uniform hole size and smooth surface and it is believed that this may have considerable benefits for aerosol collection. (b) Inertial impaction. In this technique the particles move in an air flow through a region of controlled geometry, where particles over a chosen size will impact on a collecting surface and smaller paricles will pass on through. This may be internal, which is suitable for a balloon experiment when used in cascade for particle size analysis, or it may be external, such as a suitable probe extended from a high-flying aircraft. There is also a centrifugal particle-size spectrometer, which can trap particles and distribute them in position according to their size. Since this is a new work unit, a detailed study of the above methods will first be made, and several chosen for comparison in initial balloon flights.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0011, SATELLITE EPHEMERIS COMPUTATIONS
H. GARRETT, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF247320)

AF function - satellite tracking and surveillance, ballistic nuclear weapon delivery. Deficiency - deficiencies exist in current vehicle ephemeris calculation programs in the ereas of atmospheric and geopotential models. Research - comparison and testing of advanced atmospheric and geopotential models for possible use in the Cheyenne Mountain Update Program. How research contributes - improves ability to determine and predict satellite position as a function of time with smaller computer requirements.

Computer programs involving numerical interpretation of the canonical equations of motion of an earth satellite and employing various density and geopotential models are used to predict satellite ephemerides. Test comparisons with operational density and geopotential models will be made to determine the need for making changes in operational systems. Specific emphasis is placed on computer execution time and storage. A wide range of satellites will be studied under various solar/geomagnetic conditions so as to determine the best combinations of geopotential-atmospheric models for Air Force needs.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0012, LINE-OF-SIGHT-CLIMATOLOGY
D.D. GRANTHAM, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF244020)

AF systems using visual or infrared wavelengths for detection and/or tracking, and systems using millimeter-wavelength communication. Deficiency - AF systems designated above have operations which are often inhibited or terminated due to cloud, haze or precipitation interference. Cloud-free line-of-sight (CFLOS) probabilities are needed for AF operational areas. Also, very little quantitative information exists on how often attenuation due to precipitation will effect transmission along microwave - specifically millimeterwave - ray paths at various elevation angles for differing climatic regimes. Objective - (1) to determine probabilities of cloud-free and haze-free lines-of- sight from various aircraft altitudes to earth and to space; (2) to determine joint probabilities of CFLOS at two or more locations spaced up to 400 miles apart, and to prepare a northern hemisphere atlas of CFLOS probabilities through the atmosphere; (3) to determine from radar- scope photography the frequency and extent of precipitation echoes along atmospheric ray paths for elevation angles between 0 and 45 degrees. How research contributes - (1) CFLOS probabilities will aid designers and operators in determining the utility of AF systems. (2) The atlas will depict regions where unacceptable risks of failure are expected. Models of joint probability of CFLOS will be used to estimate the number of targets expected to be simultaneously weather protected and will determine location and spacing of communications sites. (3) The resulting microwave attenuation climatology will aid designers and operators in determining the utility of AF systems, especially for those utilizing low-elevation ray paths because millimeter-wavelength propagation is severely reduced even by light rain over long segments of those paths.

A LOS in-flight data collection program will be used to gather clear, cloud- or haze-free line-of-sight observations made by airborne observers in MAC, SAC, TAC, weather reconnaissance, Navy patrol squadrons, five NATO countries and two U.S. commercial airlines. These observations are being analyzed to determine clear, cloud-free and haze- free LOS probabilities to the ground, horizon, and sky from various altitudes along flight paths over the N.H. area. (2) In a parallel effort, a model for CFLOS through the entire atmosphere has been developed. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0013, COCHISE - COLD CHEMISTRY INFRARED STIMULATION EXPERIMENT
J.P. KENNEALY, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF279450)

AF function - detection, surveillance, reconnaissance. Deficiency - inability of systems to efficiently detect and discriminate targets against atmospheric background radiation, particularly airglow, aurora, and nuclear-induced atmospheric phenomena. Objective - to provide adequately detailed information on the character of chemically induced atmospheric radiation for the purpose of optimizing system design and operational parameters. Specifically, intensive studies of atmospheric chemi-excitation processes producing ozone, nitric oxide, and the nitric oxide positive ion will be carried out. How research contributes - data acquired will permit calculation and prediction of the radiation of the atmosphere under a wide variety of conditions and of value in the development of sensors for detection of target against natural and nuclear induced phenomena.

State-of-the-art low-background infrared emission spectroscopy techniques will be used to study gas-phase phenomena in a low-density, short-contract-time, effectively surface-less environment. All experiments are performed inside a cryogenic shroud operating at 20 degrees Kelvin within a vacuum chamber; all of the components of the experiment, including the spectrometer, optics, and the cryo-pumped reaction chamber are cooled by a closed-cycle helium refrigerator and operate under the supervision of a mini-computer-based control and data acquisition system. Microwave discharges operating within the cold environment are utilized to produce the atomic and other free-radical reactants.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory OP, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0014, FORWARD SCATTER TROPOSPHERIC SOUNDING

U.H. LAMMERS, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF244920)

AF function - strategic reconnaissance. Deficiency or opportunity - direct airborne sensors for wind and turbulence monitoring are limited both in time and space. Objective - utilization of the high sensitivity of bistatic microwave scattering for wind and turbulence soundings in regions of clear air and particulate scatterers. How research contributes - extensive theoretical and experimental evidence has been accumulated indicating that the upper air wind field can be monitored using a high-resolution transhorizon microwave scatter system.

Work is in progress to scale the transhorizon system to a short- range system suitable for low-level wind sounding.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LZ, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0015, ATMOSPHERIC COMPOSITION MEASUREMENTS

R.S. NARCISI, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF244560)

AF function - communications for the B-1, AABNCP, and AWACS, performance of BMEWS and OTH-B radars, optical/ir detection systems for the DSP, upper atmospheric effects on satellite and missile operations. Deficiency - a lack of reliable predictive computer codes which can define survivable communications, radar degradations, optical/ir backgrounds and effects on AF operational satellites and missiles, for both natural and nuclear disturbances. Objective - measure the positive- ion, negative-ion and neutral composition during disturbed and quiescent conditions. How research contributes - this provides the basic data for both the development of systems computer codes and the ionospheric/atmospheric scenarios to check the validity of the codes.

Unique mass spectrometers and ancillary instrumentation are designed, tested and flown on rocket and satellite vehicles for accurate measurements of the ionic and neutral composition. The efforts are typically conducted in coordinated AF/DoD programs.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0016, PROBE MEASUREMENTS OF INFRARED ATMOSPHERIC PROCESSES

R.R. ONEIL, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF246130)

AF function - infrared optical detection systems. Deficiency - lack of knowledge of atmospheric processes controlling infrared and optical backgrounds. Objective - measurement of atmospheric parameters controlling infrared emission of CO2 at 4.3 microns produced by vibrational energy transfer from nitrogen. A series of atmospheric parameters will be measured to assist in the interpretation of the strongly enhanced 4.3 micron CO2 emission measured in the Auroral Icecap Program. How research contributes - the measurements assist in the interpretation of auroral measurements and to extrapolate these results with some confidence to estimate nuclear enhanced atmospheric backgrounds at 4.3 microns.

The experimental approach uses a rocket-borne electron source to induce optical emissions in atmospheric species. The intensity and band profiles of these optical emissions are used to infer molecular concentrations, vibrational populations and kinetic temperatures. Specifically, the molecular density of CO2 will be measured in the 80- 120 km altitude range with simultaneous measurement of N2 vibrational population and kinetic temperature.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory OP, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0017, INFRARED CELESTIAL BACKGROUNDS

S.D. PRICE, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF255280)

AF function - target detection, discrimination, early warning, acquisition, terminal guidance. Deficiency - celestial background radiation interferes with operation of airborne, rocket-borne and satellite infrared detection systems. Research - ground-based and rocket-borne measurements of infrared celestial background radiation. How research contributes - this work unit provides observational and theoretical data characterizing the infrared celestial background radiation against which a space-borne target must be detected and discriminated. Thus, it impacts the development of infrared systems to detect target against a space background. Infrared celestial measurements are obtained from ground-based and rocket-borne telescopes in the 1-to-100-micron region. Computational programs and theoretical models are developed in order to reduce, analyze and interpret the observations. The models will be used to define future system needs and the accuracy of the model will improve with improving instrumental sensitivity.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory OP, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0018, INFRARED PLUME PHYSICS

A. RAHBEE, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF256000)

AF function - missile launch detection, target discrimination, surveillance, reconnaissance, homing, depressed trajectories. Deficiency - optical infrared backgrounds interfere with detection systems and can be severe under auroral conditions and nuclear disturbances. The role of high-temperature atmospheric collisions is unknown, for example, in high-altitude plume signatures. Objective - to measure cross sections for high velocity reactions in plumes leading to potential infrared emitters and to determine reaction rates for use in perturbed atmospheric codes. How research contributes - will help sensors targets against a nuclear induced infrared background. Will also aid target discrimination at high altitudes by providing parameters of the reactions occurring in plume -atmospheric interactions. The technique of high-velocity beams permit laboratory measurements in the regime of ballistic velocities which cannot be done in any other way.

The reaction of nitrogen atoms and oxygen molecules occurring in the perturbed atmosphere was studied through homogeneous mixing in an integrating sphere of oxygen gas and nitrogen atoms obtained through microwave discharge, using modulation techniques for background discrimination. Spectral information,

gained by interferometry, is then used for comparison with synthetic spectra to determine formation rate for vibrational levels of nitric oxide. Plume - atmosphere interactions are studied employing high-intensity, high-velocity molecular beams of atmospheric species impinging upon target gases made up of plume species at low pressures ensuring single collisions. Diagnostic methods for characterizing the beam are completely worked out. Measurement of infrared intensity from plume species then provides reaction cross sections.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory OP, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0019, LARGE-SCALE OPTICAL MAPPING OF THE IONOSPHERE

E.J. WEBER, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF901290)

AF function - communications and detection. Deficiency - understanding effects of both precipitating particle and non-particle produced ionospheric disturbances on communications at high and equatorial magnetic latitudes. Objective - investigate ionospheric disturbance phenomena by observation of auroral emission features measured with a sensitive imaging system. How research contributes - the disturbed ionospheric environment affects AF ground, airborne and satellite communications and radar systems. The contribution is a better understanding of dynamic ionospheric-magnetospheric processes through measurement and analysis of associated optical emission, and better specification of ionospheric disturbances to communication satellite SPO's and DMSP, especially during times of coordinated test programs.

High-time-resolution measurements of auroral optical emissions, with large spatial coverage, will be coordinated with other simultaneous geophysical measurements from the AFCRL Airborne Ionospheric Observatory, NKC-135 aircraft no. 53131, and from selected ground stations and satellites to provide a means of assessing ionospheric response to magnetospheric substorms over sub-auroral, auroral and polar cap regions. Characteristics of precipitation particles will be derived from the optical measurements and these, together with ionosonde measurements, will be used to study the behavior of the ionospheric e and f regions. Disturbance phenomena such as sudden auroral activations, or irregular structures will be well documented to allow direct comparison of the effect of these features on AF systems.

ADDENDA: Supporting agency address is: Rome Air Development Center ETE, Griffiss AFB, N.Y. 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0020, IONOSPHERE MAGNETOSPHERE INTERACTIONS

J.A. WHALEN, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF244690)

AF function - transpolar communication, radar and navigation. Deficiency - the polar ionosphere is presently very unpredictable to such a degree that the above functions are frequently degraded or crippled. Research - to define the high-latitude ionospheric environment and its impact on AF systems. How research contributes - the high- latitude ionospheric environment affects AF ground, airborne and satellite communications, radar and navigation systems. The specific range objective (FY75) is more accurate specification of ionospheric parameters for OTH radar SPO's, communication satellite SPO's survivable communications, DMSS, GPS and AWS and their customers. The long-range contribution will be to assist the complete theoretical understanding of the complex magnetospheric interactions ultimately necessary for reliable operation of the above functions.

A final report on the causes of the aurora ionospheric scintillations impacting on the AFSATCOM, system will be completed in April 1976. An airborne expedition to measure equatorial scintillations will be undertaken in October 1976. A comprehensive study of the occurrence and lifetime of auroral brightenings undertaken for SAMSO will be completed in March 76. The analysis of additional comprehensive case studies of the midnight sector auroral phenomena will be completed in August 76.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LI, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0021, SAMPLE & ANALYSIS OF ATMOSPHERIC AEROSOLS

K.J. WHITBY, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414

The overall objectives of this project have been to sample and analyze atmospheric aerosols with particular emphasis on aerosol size distributions and aerosol chemistry. To date a large part of the effort has been devoted to the development and construction of a mobile air pollution laboratory and to its use in the RAPS program in St. Louis, Missouri.

Work for the 1974-75 project year includes (1) finishing of stages II and III software for the computerized data acquisition in the EPA mobile laboratory, (2) construction of a compact aerosol analyzer combining an optical and electrical particle counter into a single unit for the use in aircraft, and (3) participation in research in St. Louis during the summer of 1974 both on the EPA mobile laboratory and aboard aircraft, and continuation of analysis of field data obtained in California and St. Louis.

Laboratory work that will be supported by this grant includes studies of the size distribution and concentration of combustion aerosols, studies of aerosols produced in a smog chamber, and calibration studies of optical and electrical particle counters.

Important results obtained with the partial support of this grant are further evidence for the ubiquitous occurrence of bimodal mass distributions in the atmosphere, evidence for secondary aerosol formation in a power plant plume at 9000 ft. over St. Louis and in non- urban locations in California.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.D.

5.0022, ATMOSPHERIC INFLUENCES ON ECOSYSTEMS AND SATELLITE SENSING

A.C. MACE, Univ. of Minnesota, Agric. Experiment Station, *St. Paul, Minnesota* 55101 (0010830; MIN-19-035)

OBJECTIVE: Develop methods for evaluation and utilization of remotely sensed data pertaining to agricultural ecosystems for ERTS and aircraft. Develop improved statistical relationships and analyses of solar radiation and certain other atmospheric variables of fundamental impact on plant growth and yield.

APPROACH: Use remote sensing techniques to provide unlimited capabilities for measurement of hydrologic variables of diverse ecosystems. This has the capability of providing synoptic and repetitive measurements of large areas unattainable from point sampling at the earth's surface. Also provides a unique opportunity to evaluate effects of alternative land management practices on hydrologic characteristics. Satellite data will permit the location and mapping of snow distribution and subsequent zones of melt; will facilitate present research related to predicting snowmelt runoff, and stream flow forecasts will be enhanced. Albedo and energy regimes information will strengthen estimates of evapotranspiration and soil moisture content of diverse vegetation and soil types. Solar radiation data collected at field locations and research sites will be provided for development and testing of statistical analyses. Data will be subjected to developed relationships to evaluate effects of meteorological variables on forest and water ecosystems.

PROGRESS: Monitoring of water quality paramenters of a watershed which was harvested, slash piled and burned was continued. Analysis of these data is nearing completion. Solar radiation data were collected to correlate with forest ecosystem productivity. Analysis of densities of four film/filter combinations of five lakes is underway to further our knowledge of using remote sensing techniques for monitoring water quality status and changes. Water quality parameters which are being evaluated include: secchi disc, color, phytoplankton, turbidity, and estimated chlorophyll.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0023, INTERPRETATION OF PROPERTIES OF PRINCIPAL MINNESOTA SOIL SERIES

R.H. RUST, Univ. of Minnesota, Agric. Experiment Station, *St. Paul, Minnesota* 55101 (0001806; MIN-25-018)

OBJECTIVE: Develop, from available data, interpretive classifications of land for a variety of uses - agriculture, forestry, residential and industrial development, recreation, and transportation.

APPROACH: The principal effort would be in development of information retrieval and display systems - tabular and graphic - of original and derived data correlated with the specific interpretation. Means or methods would be developed to provide 'instant' or 'on line' interpretations at several generalizations so as to serve the needs of the individual developer or manager, as well as the large-scale regional planner. The recent developments in computer 'visigraphics' would be investigated for application.

PROGRESS: The effort to delineate areas of saline-affected soils in the northern part of the Red River Valley was concluded. An area of about 125,000 acres with varying degrees of salinity will be shown on the soil association map in the Kittson County soil survey report. The use of color infra-red imagery for detection of significant soil features important to classification and management continues under study in Clay county. In early June 1975 imagery was obtained at a scale of 1:20,000. Degrees of drainage, or surface wetness, can be more correctly delineated in the soil survey. The Minnesota Land Management Information System (MLMIS) continues the process of encoding the Atlas map series (scale 1:250,000) by 40-acre cells for computer map plotting capability. Also encoded are selected physical and chemical features of the soils and landscapes. A simultaneous effort is to develop statewide land use interpretations in 3 areas - agriculture, forestry, and medium- density residential land suitability. A statewide crop equivalent rating guide has been developed and published which includes relative ratings on about 500 soil mapping units broadly representative of the state. A pilot study was made of certain agricultural areas to assess availability of crop residues for energy conversion. Information was largely drawn from the Soil Atlas data system. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0024, ACOUSTIC EMISSIONS FROM TORNADIC STORMS

R.T. ARNOLD, Univ. of Mississippi, School of Liberal Arts, *University, Mississippi* 38677 (ATM76-08708)

The primary objective of this research is to obtain high-fidelity recordings of the sound produced by tornadic storms. It is a legitimate matter of scientific debate whether or not a study of low-frequency sonic pressure waves generated in a tornadic storm can be used to gain insight into the nature of the physical characteristics of either the tornado cyclone or the larger parent storm cell. However, based on a study of three records made with low-quality acoustic recorders, the principal investigators are of the opinion that high-quality recordings can provide information about wind speeds, wind turbulence, electrical activity and the total energy associated with the wind system. The detailed objectives are: (1) The measurement of wind noises associated with wind-ground surface interactions, (2) To record thunder spectra of several travelling storm cells which cross the National Severe Storms Laboratory's (NSSL) weather network, and (3) To attempt to record the sound generated by one or more tornadoes by working closely with the Tornado Intercept Group at NSSL. Instruments suitable for recording infrasonic and sonic signals in the range from 5Hz to 10KHz will be used and the power spectra produced and analyzed. A possible practical benefit of this research is a sonic tornado early-warning detector.

SUPPORTED BY U.S. Natl. Science Foundation

5.0025, ANALYTIC DESCRIPTION OF THE GROWTH AND DECAY OF GRAVITY WAVES

J.T. LIU, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DN223187; N00014-76-C-0363)

The duration and length scale of turbulent fluid dynamics disturbances in the atmosphere and ocean are critical factors in naval missions. For example, both the discrimination of submarine-induced turbulence and the detection of atmospheric clear-air turbulence are related to the persistence of shear flow instabilities in stratified fluid media. Such disturbances and their phsyical differences from ambient conditions of the embedding environment must be delineated before one can determine ranges of possible detection.

The generation and breaking of gravity waves induced in a shear flow of a stratified fluid are only vaguely understood because the processes involve nonlinear interactions of turbulent scales with the organized motion of the fluid. Thus far no comprehensive analytic description of the genesis and history of the phenomena has been successful. This task proposes a numerical model to achieve this end, and by varying initial conditions to discover how Kelvin-Helmholtz waves will grow and break. The consequent downstream turbulent patches will be followed to note their decay modes and scales of persistence. Thus, a description of the range and intensity of the phenomena will be obtained to compare with existing empirical data and suggest experimental avenues for the future.

ADDENDA: Supporting agency address is: Office of Naval Research 438, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0026, ATMOSPHERIC WATER VAPOR

T. ASHWORTH, South Dakota School of Mines, School of Arts, *Rapid City, South Dakota* 57701 (DN323084; N00014-75-C-0214)

To fill the need for an expendable in situ humidity sensor for very low atmospheric humidity to be used in conjunction with the development of remote sensing techniques for water vapor in the atmosphere, the aim of this research is to attack the complex of problems involved in the testing, calibration, modification, and development of such sensors. The research will benefit Navy efforts to cope with the refractive-index problem that hampers modern weaponry.

A low-humidity chamber will be used to examine and calibrate existing sensors, particularly those prepared on NR 082-176. The chamber is reliably calibrated to dew points of -10 C. It can go to dew points of -80 C with less reliable calibration. Better calibration of the chamber is part of better calibration of the sensor improvement under this task.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0027, HIGH-ALTITUDE TETHERED BALLOON DESIGN AND FABRICATION

UNKNOWN, Raven Industries Incorporated, *Sioux Falls, South Dakota* 57101 (DF246430; F19628-76-C-0149)

AF function - advanced high-altitude tethered balloon system for surveillance, monitoring, environmental research, and space vehicle test. Deficiency - current tethered balloon technology and equipment limits the use of this type of vehicle to altitudes less than 10km. Objective - design and fabricate a balloon capable of being raised to and tethered at an altitude of 20 km. How research contributes - development and flight at 20 km will prove the feasibility of operating tethered balloons under these conditions on an operational basis.

The design of a balloon capable of carrying a 200 lb payload and over 1600 lbs of tether cable to 20 km will be undertaken. Simplicity of the design for allowance of a 10-fold gas expansion from the ground to altitude, reliability of balloon control techniques, and economy will be prime characteristics sought in the design stages. Fabrication of one or two free-flight models will allow evaluation of the approved design and modifications before the final balloon is constructed. This final balloon will then be tested as a tethered system.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LC, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0028, NAVY ENVIRONMENT - BALLOON CLOUD PROBES

A.A. FEW, Rice University, Graduate School, *Houston, Texas* 77001 (DN123363; N00014-75-C-0139)

To apply modern balloon technology to the probing of maritime clouds in order to support naval operations through a better comprehension of atmospheric phenomena.

Balloons of special construction will be prepared with sensing equipment and telemetry contained within the balloon. The balloon surface will also be used for sensing. The balloons will be released as free balloons into clouds and be supplemented and compared with standard radio sounding techniques.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0029, THUNDERSTORM SPHERICS

D.R. TOMPKINS, Terrene Corporation, *Refugio, Texas* 78377 (DN223331; N00014-76-C-0404)

In the interest of improved safety of flight operations and thunderstorm forecasts, this research aims to remotely sense the electric fields of clouds and thunderclouds.

The technique of measurement employs the shower ionization produced by cosmic-ray showers through thunderstorms. Particle counters determine when a shower occurs by means of a coincidence circuit which in turn initiates recording of each antenna's wave form in the antenna array. Analysis of the radio signal obtained allows solution for source currents which along with estimated shower size lead to electric field estimates in the storm.

ADDENDA: Supporting agency address is: Office of Naval Research 412, Arlington, VA. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0030, OPTICAL POWER SPECTRUM (OPS) ANALYSIS RELATED TO CHANGE DETECTION

G.E. LUKES, U.S. Army, Coherent Optics Center, *Fort Belvoir, Virginia* 22060 (DA0M8061)

Investigate the feasibility of hybrid coherent optical/digital techniques for the detection of significant changes in cartographic information imaged in multidate aerial photography. The optical power spectrum (OPS) analysis technique is being investigated using a coherent optical system utilizing analytical sample positioning procedures and mathematical pattern recognition procedures for decision making.

To assemble a set of sequential aerial photography which documents significant cartographic land use changes. To generate an OPS data base by using the recording optical spectrum analyzer (ROSA) to sample specified ground locations imaged in each photo applying analytical sampling procedures developed in FY 75 under 91D/01/0046. To investigate the use of mathematical pattern recognition techniques to identify land use changes imaged in multidate aerial photography.

ADDENDA: Supporting agency address is: OCE ETL Center for Coherent Optics, RI, Ft. Belvoir, VA 22060

SUPPORTED BY U.S. Dept. of Defense - Army

5.0031, WAVES THROUGH RANDOM MEDIA

A. ISHIMARU, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (DF241880; F19628-74-C-0005)

AF function - high-data-rate communications. Deficiency - communication frequency bands heavily allocated - new frequency bands are required for high-data-rate communications channels. Research - analyze and study propagation and reception of waves, which may be bounded and unbounded in space and may be modulated in time, in turbulence and discrete particles, such as rain or fog, in the atmosphere. How research contributes - the study will contribute to the better understanding of the effects of random media and discrete scatterers on communications, remote probing, and target detection. The fluctuations, correlations, and spectra will be studied for waves which may be multifrequency and wideband, by taking the effects of beam cross section, wind velocity, particle size, and so on, into account. The study will be applied to remote probing of atmospheric parameters and to detection of targets in random media.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LZ, L. G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0032, COMMUNICATIONS - WAVE EMISSIONS AND PARTICLE PRECIPITATION AT VLF

G.K. PARKS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DN475427; N00014-67-A-0103-0039)

The objective is to evaluate the effect of the ionosphere on radio communications systems used in Navy operations and to help in the design and operation of such systems. The propagation and attenuation of very low frequency radio signals by the ionosphere, from both ground-based and satellite transmitters, are governed by the electron and ion densities in the ionosphere. The present work will examine magnetospheric ionospheric coupling and resulting radio emissions and particle-precipitation through wave-particle interaction mechanisms.

Measurements will be made of atmospheric bremsstrahlung X-rays from precipitated energetic electrons in the region near the magnetic conjugate of the ATS-F satellite by means of balloon-borne detectors. These results will be correlated with observations of electrons and protons of energies greater than 20 keV in the equatorial plane of the magnetosphere made from the ATS-F satellite. The data will be examined to find whether precipitation and acceleration processes are common to both auroral and magnetospheric regions and whether other processes act on particles in their transit between the equator and the ionosphere.

ADDENDA: Supporting agency address is: Office of Naval Research 421, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0033, LAKE CLASSIFICATION PROJECT

F.I. SCARPACE, Univ. of Wisconsin, Inst. For Environmental Stud., *Madison, Wisconsin* 53706 (A-062-WIS)

This investigation is concerned with attempting to derive a number which is correlated to the eutrophic status of inland lakes in the State of Wisconsin from the Earth Resources Technology Satellite (ERTS) imagery. Preliminary work has indicated that a measurement of turbidity can be made by finding the ratio of reflected energy as measured from band 5 to band 7 for lakes in Wisconsin. A number that indicates the eutrophic status of lakes will be derived by considering the average turbidity during the summer months as well as the variation. Correlations will be made to ground truth gathered by the Wisconsin Department of Natural Resources (DNR). The measurements on the ERTS imagery for the majority of the lakes in Wisconsin will be done by personnel of DNR.

SUPPORTED BY U.S. Dept. of Interior - O.W.R.T.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, EVALUATION OF VISUAL DISCRIMINATION PRETRAINING

B.J. EDWARDS, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222210)

To investigate the effectiveness of specific training methodologies in training the essential visual discriminations required to perform the final turn of the normal landing pattern and to develop a set of audiovisual training materials which will provide training for student pilots in these visual discriminations.

An iterative training product development cycle will be employed to develop audiovisual materials for use in training of the visual discriminations. Instructional systems development (ISD) procedures and methodologies from the fields of educational technology and educational psychology will be employed. The effectiveness of experimental training materials in imparting visual discrimination skills will be empirically validated and then evaluated by executing the final turn in simulated and real time environments.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTT, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0002, A STUDY OF ASUPT PREPROGRAMMABLE FLIGHT DEMONSTRATION CAPABILITIES

R.W. MCFADDEN, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222050)

To compare and evaluate the instructional potential of the advanced instructional provisions (AIP) available on ASUPT and to define the optimal use of instructor pilots in conjunction with AIP.

UPT preflight casual students at WAFB will be trained in ASUPT on standard ATC maneuvers under one of three experimental syllabi comparing the conventional student-IP instructional techniques with ASUPT's preprogrammable maneuver demonstrations. The students will be required to meet IP established criteria recorded by the advanced instructional provisions performance measurement feature of ASUPT.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTT, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0003, RESEARCH TO IMPROVE THE TECHNICAL BASE OF NOISEMAP

D. BISHOP, Bolt Beranek & Newman Inc., *Canoga Park, California* 91303 (DF314500; F33615-76-C-0507)

The cornerstone of the Air Force Air Installation Compatible Use Zone (AICUZ) program is the aircraft noise exposure (NOISEMAP) predictive procedure which describes the noise environment around our air bases and thereby aids air base planners to prevent further encroachment which could limit the effectiveness of the installation. NOISEMAP is also used Air Force-wide in preparing/assessing environmental impact statements for noise from aircraft operations, in evaluating cost-performance- noise trade-offs in the development of proposed aircraft/propulsion systems, in determining ground runup suppressor requirements, in siting of new or noisy facilities, and in assigning/relocating aircraft. The objective of this research is to provide the additional research needed to improve the technical defensibility of NOISEMAP in cases of litigation.

The contractor will improve the technical basis of NOISEMAP by incorporating new developments in the state-of-the-art as they occur, develop additional technical guidance/instructions for the application of NOISEMAP, evaluate the susceptibility of NOISEMAP to local topography, conduct additional NOISEMAP sensitivity studies on various parameters to substantiate preliminary findings using the 'selected operations' analysis technique, develop a test plan to improve the data base for the excess attenuation algorithm currently used, and investigate the effects of fuselage shielding on the noise exposure predicted by NOISEMAP for multi-engine aircraft.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0004, DIFFRACTION OPTICS STUDY

R.N. WINNER, Hughes Aircraft Company, *Culver City, California* 90230 (DF319920; F33615-76-C-0508)

The objective of this effort is to determine the feasibility of utilizing holographic optical elements in advanced operator-centered display concepts. More specifically, this effort will extend current research efforts being conducted by AMRL in the holographic optics area by determining the feasibility of utilizing phase diffraction optics in a reflection mode on various areas of an aircraft canopy and in a transmission mode on the pilot's flight helmet visor.

The research on this program will involve the assembly of a technical project team having representatives with demonstrated expertise from all of the technical disciplines involved including electronic image generation, chemistry and materials technology, avionics and flight control displays, optical design and system analysis, and human factors engineering. It will also require the use of an optical ray-tracing program capable of both conventional and multiple holographic optical elements. This represents the initial feasibility analysis of the application of holographic optics technology to the advanced display concepts described in the statement of work. This effort will be a high-intensity, coordinated systems analysis involving all disciplines of the technical team simultaneously rather than a drawn-out series of piecemeal analyses of the problem. It will culminate in an analysis report containing technical performance capability and trade-off data associated with parameters in these advanced display concepts. It will also provide insight into areas where technology advanced would have a significant effect on system performance along with specific technical performance improvements as a result of these advances.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0005, FIREFIGHTER TRAINING EFFECTIVENESS

B.E. DALLMAN, U.S. Air Force, Human Resources Laboratory, *Denver, Colorado* 80230 (DF221710)

Firefighter training has traditionally relied on realistic training exercises using actual fires. Devices exist which can produce training fires having virtually no smoke associated with them. The objective of this study is to determine whether training under smoke-abated conditions produces any decrement in overall training program effectiveness. This determination will be limited to simulated aircraft crash fires. This work is being accomplished in direct response to a letter request (29 Jan. 74) from the Air Force Civil Engineering Center, Tyndall AFB, Florida.

Students trained in the conventional manner will be compared with students trained under smoke-abated conditions to see if there are differences in firefighting performance during a simulated full-smoke aircraft crash fire. Performance data will consist of time to extinguish the fire and correctness of procedures. In addition, opinion data will be collected from instructors and students to determine whether smoke- abated training is perceived as acceptable.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory TTT, Lowry AFB, Colorado 80230

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0006, VALIDATION OF AIRCRAFT NOISE EXPOSURE PREDICTIVE PROCEDURES

D. BISHOP, Bolt Beranek & Newman Inc., *Cambridge, Massachusetts* 02138 (DF319510; F33615-76-C-5003)

The cornerstone of the Air Installation Compatible Use Zone (AICUZ) program is the NOISEMAP predictive procedure, which is used to describe the noise environment around air bases and thereby aid air base planners to prevent community encroachment limiting the effectiveness of the installation. NOISEMAP is also used Air Force-wide in preparing/assessing environmental impact statements concerning the noise from aircraft/airbase operations, in evaluating cost-performance-noise tradeoffs in the development of new aircraft/propulsion systems, in determining ground runup suppressor requirements, and in the siting of new or noisy facilities. The objective of this research is to validate through long-term noise measurements the major aircraft noise exposure prediction algorithms contained in noisemap.

The contractor will review all aircraft noise exposure maps previously prepared and recommend four air bases where noise exposure validation measurements should be made. The contractor will conduct noise measurements for 1-3 weeks on and about the bases to acquire the data necessary to validate and/or modify the noise predictive algorithms in NOISEMAP for runup, traffic pattern, takeoff, and landing operations. During all field noise measurements the contractor will acquire and verify the detailed aircraft operational data needed as input to NOISEMAP to compute the noise exposure at the test sites. NOISEMAP computations will be made and compared with the measured values and detailed error analyses performed to account for the differences between measured and predicted values.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0007, RECORDING AND MODELING OF HUMAN EYE MOVEMENTS - AN APPLICATION TO UNDERGRADUATE PILOT TRAINING
W.B. ALBERY, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF227890)

To investigate the physiology of the human visual control system, to review previous models and develop new models for the system using data from advanced bio-medical instruments, to investigate the applications of these instruments to the flight training environment, and to suggest avenues of research opened by the development of advanced eye-movement recorders.

Technical literature will be surveyed, relevant engineering models of the eye will be reviewed, models will be implemented on a computer (analog or digital), and an eye-movement camera recorder will be used in an aircraft and simulator (ASUPT) in order to determine the applicability of eye movements to training. A technical report of the results will be published at the end of the study.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory ASM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0008, APPLIED PHYSICAL ANTHROPOLOGY FOR DESIGN OF AF SYSTEMS
M. ALEXANDER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF319190)

This work unit provides consultancy and guidance for the application of engineering anthropometric data in support of engineers and designers, and aids in the evaluation of the application of these data in end items and systems. Principal areas of work are related to the sizing and design of personal protective equipment for hazardous environments and the integration of the man (fully encumbered pilot) with his work station (cockpit).

Detailed anthropometric data form the basis for guidance in the design, sizing and procurement of clothing and personal protective equipment and for the design and layout of work spaces. These data to be effective must reflect the practical requirements of a design problem and/or end item. Each design task becomes a matter of reanalyzing the existing data, or developing new data as needed, to meet the specific requirements of a particular anthropometric design problem. This effort was formerly included under work unit 71840803, Anthropometric Design Criteria for AF Systems.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0009, AIR COMBAT ANALYSIS
A.K. CLADER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF318940)

To provide Air Force mission planners with information concerning pilot capability in threat aircraft systems. This will allow increasingly more valid projections to be made of manned aircraft threats to manned weapon aircraft systems of interest.

The Dynamic Environment Simulator will be used to provide information on human operator models for the high-acceleration cockpit and the Advanced Fighter Technology Integration (AFTI) program. Further, in 689302, pilot-modeled algorithms will be provided to Air Force studies and analyses for incorporation into air-to-air attrition modeling. Inherent in these data are sources of information which can provide data for threat assessment. No specific experimentation for threat assessment is planned in FY75 and 76.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0010, SIMULATION TECHNIQUES FOR MANNED WEAPON SYSTEMS
J.W. FRAZIER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF316930)

To provide the facilities to simulate effectively the human stress regimes characteristic of aircraft mission scenarios. This in-house effort seeks to increase the capability of the man-rated Dynamic Environmental Simulator (DES) in visual display techniques, multi-space control, buffet capability, and aerial combat simulation. Included are the instrumentation, physiologic monitoring techniques and real-time computational approaches to information display. The effort supports Joint Technical Coordinating Group activities in attrition modeling and optical countermeasures studies in related programs. Also included are DES operations and support activities and development of improved restraints. New operating techniques are developed for more efficient use of personnel and equipment. System safety analyses are developed, tested and implemented. Consultations to outside agencies are also included (i.e., Lightweight Fighter SPO, B-1 SPO, AFFDL).

The effort uses applications of computer-generated display techniques. Gunsights and maneuvering targets are displayed to permit task performance scores to be obtained in terms of cannon fire hits. Television projection systems are planned to upgrade the out-of-cockpit peripheral viewing area. A controller to handle DES motion simulation with greater fidelity is under development.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0011, PATHOLOGICAL EVALUATION OF TOXIC INJURY
A. HALL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF315120)

To define the morphology and mechanisms of toxic injury at the cellular level.

To describe by light and electron microscopy and to document the pathologic change seen following toxic injury in experimental animals. To integrate these changes with clinical chemistry and hematological changes, and then ultimately, to correlate these changes with cellular biochemistry. To perform morphometry on tissues and cells at the microscopic level. To determine the efficacy of drugs used for treatment of intoxication by evaluation of change in animal tissues and blood. To perform quality control on animals used in toxicity studies employing hydrazines and haloalkanes.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab TH, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0012, DYNAMIC RESPONSE OF MAN TO EXTERNAL MECHANICAL STRESS ENVIRONMENTS
I. KALEPS, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF313000)

The purpose of this effort is to develop analytical and computer techniques for a thorough understanding and evaluation of injury mechanisms observed in aircrew members exposed to mechanical stress environments such as short-term, high-g impacts, blast, vibration, noise, and aerodynamic forces. The final objective is a capability to evaluate, by quantitative means (analytic and/or computer), an aircrew member's dynamic response to high-mechanical-stress exposures either in operational systems or those still in the design stage, and provide detailed, comprehensive and quantitative information about the injury potential to the subject from such systems.

Analytic and computer methods will be developed to model the actual highly complex mechanical dynamics of the human body. These models will fall into several categories depending on the type of event to be studied. However, they will encompass the spectrum of dynamic events of interest to the Air Force. Included in this development will be models for the three-dimensional analysis of the human head-spine system, articulated total body motion, thoracic dynamics, head impact, cardiovascular system dynamics, and various external body constraint and restraint systems. Concurrent to the analytical and computer model developments, a program will be conducted to compile a physiological data base defining physical parameters for the biodynamic models.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0013, DISPLAY TECHNIQUES FOR CLOSED-LOOP HUMAN CENTRIFUGE SIMULATION
A.R. MARKO, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF319090)

The Dynamic Environment Simulator (DES) is employed to produce inertial forces on a human test subject similar to forces experienced in aircraft in combat. This centrifuge is used to measure human tracking and ordnance delivery performance, test new cockpit designs, evaluate protective equipment and determine safety limits for human exposure to g forces. It is the objective of this effort to develop improved displays for the dynamic environment simulator in order to provide realism of displays in studies on manned weapon system effectiveness in the air combat arena.

A display system based on a television technique has been selected because of inherent versatility. Input to the display will be a video signal generated from simulator facilities, terrain boards, flying spot scanners, or computers. A spherical mirror together with a 23-inch television monitor or projection system will be used. Flight simulator displays have been evaluated for potential use in the DES. Components for the construction of a first laboratory model display have been selected and ordered. Preliminary electronic circuit design work has been started.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0014, EFFECTS OF VISUAL-MOTION CUE CONFLICTS ON THE CONTROL OF REMOTELY PILOTED VEHICLES
L.E. REED, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF227350)

To determine the effects of visual-motion cue conflicts on the ability of Air Force personnel having different flight experience to learn to operate remotely piloted vehicles (RPVs) from either airborne or ground stations. Cue conflicts will be encountered in RPV control systems with inputs from (1) the motion of the airborne station, and (2) the visual image from the RPV television monitor. The results of this study will provide needed data on the adequacy of fixed- vs. moving-base platforms for RPV operators' skill acquisition, the types of Air Force personnel best suited to operate RPVs, and the length of time needed to effectively train these personnel.

The experiment will be conducted in the simulation and training advanced research system (STARS) facility. Included in this facility is a remote operator task station (ROTS) mounted on a moving-base platform to simulate the environment of an airborne control station. Three groups of subjects, representing three levels of experience, will be compared: (1) rated pilots, (2) rated navigators, and (3) non-rated officers. The task will consist of tracking ground targets and maintaining a fixed horizon and heading on the video display. Step functions (visual and/or motion with pitch and/or roll combinations, depending on the experimental treatment) will be introduced to simulate the effects of clear air turbulence on the control station and/or the RPV. The dependent variables are based on single-axis responses to discrete step inputs. All measurements will show the effects of cue conflicts on operator control activities and the rate at which each experience group learns to disregard cue conflicts or learns to use other cues that will provide an adequate frame of reference.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory ASR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0015, EFFECT ON BODY FUNCTION OF VIBRATION ENVIRONMENTS OF AIR FORCE OPERATIONS
D.V. STURGES, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF312240)

The objective of this effort is to determine physiological responses to flight-type vibration forces. Responses of crew and passengers to vibrations encountered in such Air Force operations as prolonged low-altitude, high-speed flight, defensive maneuvers, and terrain avoidance are required to understand performance decrements and protection requirements. Results are used to develop (1) models for predicting injury or performance decrement, and (2) criteria for attenuation/isolation.

Human and animal subjects are exposed to vibrating or oscillating force environments using a shaketable, motion simulator, or dynamic pressure chamber. Physiological parameters such as blood flow, temperature, or nerve conduction velocity are measured. X-rays and biochemical assays are taken. Correlation is made or attempted with biodynamic parameters such as transmissibility and mechanical impedance in conjunction with project 7231-01-02. Responses are modeled and mechanisms identified which must be overcome to effect protection, or assisted to enhance performance.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0016, RESEARCH ON HUMAN RESPONSE TO INCLUDE OPERATION AND MAINTENANCE OF NECESSARY MOTION SIMULATORS
G.T. COLLINS, Univ. of Dayton, Res. Inst., *Dayton, Ohio* 45409 (DF317930; F33615-76-C-0401)

Effects of chronic and acute exposure of humans to vibration stress are not sufficiently well understood to permit optimal weapon system design. The primary goal of this effort is continued safe operation of the branch's motion simulators in support of in-house research. Emphasis on in-house control of experiments with human subjects dictates that protocols and interpretation of reduced data be controlled by Air Force personnel. Additional research is therefore aimed at obtaining support in carrying out approved protocol, obtaining data, and improvement or modification of simulators to give special environmental simulation.

The contractor will (a) establish and/or maintain safe operational procedures for all branch motion simulators and power supplies in operational status, (b) provide continuing operational and engineering support for said simulators and power supplies, (c) provide research into special instrumentation required for experiments carried out on said simulators, (d) provide data collection, reduction and analysis support for experiments carried out on said simulators, (e) provide research required to modify said simulators, their power supplies or their control systems when special environmental simulation is foreseen, (f) provide orientation in operation and maintenance of branch motion simulators to otherwise qualified newly assigned in-house personnel.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0017, HYDROXYLATED CONJUGATED EXCITED STATE DERIVATIVES OF CELLULAR METABOLITES IN BODY FLUIDS AS STRESS INDICATORS IN AIRCREW
B.D. POLIS, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN333005)

To determine unique derivatives of cellular metabolites and bioregulatory factors like o-hydroxy hippuric acid in the urine of humans exposed to stressful aerospace environments. The goal is to achieve predictive indices of stress intolerance which will reveal the exhaustion of adaptive mechanisms and the onset of pathology.

Thin-layer and high-pressure liquid chromatography will be used in conjunction with e.s.r. and fluoresence spectrophotometry to detect and quantitate the organic solvent soluble components extractable from the acidified urine of control and stressed military flight personnel. Results will be correlated with other stress indicators like blood phospholipids to achieve a biochemical indication of stress pathology.

ADDENDA: Supporting agency address is: Naval Air Systems Command Research Administrator (310C), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0018, BIOMEDICAL CRITERIA FOR ADVANCED RESPIRATORY LIFE SUPPORT SYSTEMS
F.W. BAUMGARDNER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF318780)

The performance of breathing systems must insure adequate physiologic function to users in diverse operational environments. In dynamic operation current inventory regulators waste oxygen, exhibit flow limitation, and impose physiologically stressful breathing pressure on the cardiopulmonary system of the user. The primary objective of this work unit is to establish concepts and data for the development of systems which optimize oxygen delivery in advanced and conceptual aircraft. Additionally, selected parameters will be examined to identify appropriate ones which will indicate individual oxygen requirements under various flight profiles and degrees of stress and the feasibility of demand-supply matching systems will be assessed. These efforts are coordinated with AFFDL/FEE and ASD/SML on a continual basis in accordance with letters of agreement, and close technical liaison is maintained with Oklahoma City ALC, ASD/ENCCE, and NADC.

Human volunteer subjects will participate in a series of experiments to determine correlations between physiologic variables such as ventilatory flow, ventilatory pressure, tidal volume, respiratory frequency, respiratory period, inspiratory time, expiratory time, the time derivative of initial inspiratory pressure and flow, and minute ventilation and oxygen consumption. Preliminary experimental studies will employ human subjects at simulated altitude or in a human centrifuge, at varying levels of exercise and environmental stress conditions.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0019, EFFECTS OF WEAPONS RADIATION ON AIRCREW TASK PERFORMANCE
G.C. BROWN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF315770)

The development of mathematical models of crew survivability/vulnerability analysis is dependent upon accurate descriptions of performance effectiveness under radiation environmental conditions. Studies of high-dose, high-dose-rate exposures have largely been completed. Emphasis will be placed on lower dose and dose rates, specific long-mission scenarios and complex interactions of ionizing and non-ionizing radiation with task requirements. The objective of this effort is constructed dose-response curves for radiation environments and interactions of interest to SAC. Specifically, the combined effects of multiple radiation pulses, sustained low-dose-rate exposure and aircrew task complexity upon system performance effectiveness will be determined. The description of aircrew performance during and following irradiation, for the purpose of S/V model applications (7757-05-23), is the goal of the effort.

Selected models of operational task requirements will be utilized. Highly accurate simulations of specific system dynamics will be constructed and analyzed through application of mathematical control theory. Closed-loop studies of operator control capabilities in radiation environments will be assessed through the identification, description, construction and utilization of continuous (tracking) tasks. An elaboration of the problems of motivation, fatigue, work load and time stress will be undertaken to further strengthen S/V model predictions.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine RA, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0020, CARDIOPULMONARY ASPECTS OF PHYSICAL EXERCISE IN FLYING PERSONNEL
V.F. FROELICHER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF311470)

The leading medical cause for removal of aircrew men from flying status is disease involving the circulatory system. This effort is to determine the value of physical exercise in the early detection of cardiopulmonary disease, in quantifying the significance of such disease to the flyer, and the value of physical fitness programs in preventing or modifying the effects of such disease. The value of physical fitness in enhancing the effectiveness of the normal aircrew man will be assessed.

Flying personnel are studied during maximum exertion to provide better understanding of normal/abnormal physiology, and follow-up is made to help establish the influence of physical condition on the course of circulatory disease. Evaluation of exercise testing procedures, types of exercise programs, monitoring methods, and development of better methods of measuring work performance will continue. The value of anaerobic work measurements (e.g., blood lactate pyruvate levels, and oxygen debt) will be under study. A computer program for exercise ECG analysis has been developed and results will be correlated with other aspects of disease for diagnosis. Various approaches to the problem of studying cardiac metabolism under stress will be investigated in an attempt to develop more applicable clinical tests for heart disease.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0021, AIR COMBAT MANEUVERING (ACM) TRAINING
S.D. LEVERETT, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320130)

To improve and increase the knowledge of TAC fighter pilots, physiological training officers and flight surgeons with the effects of both sustained or simulated air combat maneuvering g forces (SACM) as obtained from training on the USAFSAM human centrifuge.

By using the USAFSAM human centrifuge to simulate maneuvering g forces in high-performance aircraft, pilots, flight surgeons, or physiological training officers are able to practice their straining techniques to improve g tolerance and gain first-hand knowledge for teaching the technique to others. These individuals will be exposed to these training epochs on the USAFSAM centrifuge while they are attending academic courses at SAM.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0022, AREA SAFETY MONITORS FOR ROCKET PROPELLANTS
L.J. LUSKUS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF319410)

This effort provides detection concepts and prototype instrumentation for monitoring extremely hazardous and toxic rocket propellants. Development of area detectors and monitoring devices is urgently needed for the handling, transfer and sampling of such unique chemicals as the hydrazine homologs and halogen fluorides. The requirement exists both in rocket testing and missile maintenance to provide maximum lead time for donning of protective garments, and to insure a continuous record of occupational exposure. This work supports AFRPL-TN- 2109-74-01, and the SAMSO development of a toxic vapor detector for Minuteman III SILO maintenance operations.

At the letter request of SAMSO/MNBS, an AFRPL-developed quadrupole mass spectrometer will be evaluated in FY75 for sensitivity and interference in monitoring monomethylhydrazine and nitrogen tetroxide for Minuteman III application. In FY 76, the spectrometer will be evaluated for detection of other rocket propellants of interest to AFRPL, including mixed amine base and hydrocarbon fuels. The feasibility of using gas-phase chemiluminescent methods for low-level detection and monitoring of pentaborane and halogen fluoride oxidizers will be investigated as a parallel FY 75-76 development effort.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0023, THE EFFECTS OF ITEM-OPTION WEIGHTING ON THE RELIABILITY AND VALIDITY OF THE A F OF-

FICER QUALITY TEST AS USED FOR THE SELECTION OF PILOTS
M. REE, U.S. Air Force, Human Resources Laboratory, *San Antonio, Texas* 78236 (DF232380)

To investigate the effects of item-option weighting on the internal consistency reliability and standard error of measurement on the AFOQT as used in the selection of pilots. The study will also investigate the effects of item-option weighting on the validity of the pilot selection composite and on the magnitude of subtest intercorrelations. The study will compare the results of item-option weighting with the procedure currently used. Benefit to the Air Force is potential improvement in pilot selection.

A sample of 2000 officers who began pilot training and who took a single form of the AFOQT will be selected. 1000 will be randomly selected into the validation sample and 1000 into the cross-validation sample. Their test item responses will be used to develop item-option weights for each option of each item in the AFOQT. The speeded section will be shortened to render it effectively unspeeded. Three scores will be developed for each subject. These scores are: sum of the number marked correctly, the conventional correction for guessing, and the sum of the item-option weights selected. Reliability of the three scores for the pilot composite and individual subtests will be compared. Item- option weight reliability will be estimated via parallel forms from validation and cross-validation samples. The criterion for validation will be passing/failing pilot training. The validity of the three scoring system for composites and subtests will be compared. Cross validation will be carried out. The effect of the item-option weighting on subtest intercondition will be investigated by comparing the intercorrelation obtained using each of the three scoring systems.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory PES, Lackland AFB, Texas 78236

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0024, APPLICATION OF HUMAN PERFORMANCE METRICS TO WEAPONS SYSTEM UTILIZATION
W.F. STORM, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF317360)

A number of USAF operational problem areas require total or partial laboratory study, as opposed to field study, for purposes of safety, feasibility, and expense. The objective of this work unit is to update the technology necessary to determine changes in the human as a result of operational/environmental stresses. Whenever possible, in-house work parallels and complements field work under work unit 7930-09-11, Performance and Physiologic Factors in Crew Fatigue. In-house studies permit increased experimental control of all factors, thereby allowing better interpretation of results than is sometimes possible from field data. Examples of operational problems which have and will be studied are the influence of pharmacological agents, sudden awakening during a simulated alert, and work/rest schedules for long-term alerts.

A broad spectrum of performance techniques involving flight simulation, psychomotor tracking abilities, cognitive and vigilance skills, and problem-solving abilities have been developed. This technology will be available for single or combined utilization, and flexibility will be maintained in order to permit experimental response to a broad range of operational problems. A data base will be derived from each approach, thereby allowing a comparison between experiments as they are completed.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0025, VISUAL SYSTEM DISEASES IN AIRCREW MEN
T.J. TREDICI, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF311720)

To determine incidence and significance of diseases of the visual system in flying personnel from the standpoint of retention without compromising flying safety. Develop the means to prevent or correct such disorders. Develop technics for early diagnosis or prediction of development of such disorders.

Flying personnel with ophthalmologic problems receive a comprehensive aeromedical evaluation and a battery of function testing, including manifest and cycloplegic refractions, motility tests, tonometry, tonography, funduscopy and fundus photography. Response to aerospace environmental factors (e.g., acceleration, altitude and electromagnetic radiation) is studied in special cases. Longitudinal basic studies will assess the significance of disease in relationship to flying operations and the validity of current aeromedical standards. Fluorescein fundus photography, electro-retinography, electro- oculography, static perimetry, and biomicroscopy will be utilized in studying the effect of disease and stress on aircrew men.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0026, DEVELOPMENT OF ANALYTIC LABORATORY TECHNIQUES APPLICABLE TO THE MEDICAL EVALUATION OF FLYING PERSONNEL
R.G. TROXLER, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF311630)

In the evaluation of the medical status of flying personnel, and in the support of the investigation of aerospace medical problems, there is a requirement for the development of improved analytic laboratory techniques to extend the capability of Air Force to treat and detect serious diseases in early state or to prevent them entirely. This effort will develop new techniques and equipment to answer this requirement, with emphasis on precision and accuracy, automation, and reduction in sample size to better differentiate normal physiologic changes from disease states.

Present equipment and techniques will be evaluated and modified to produce the most precise, accurate and efficient methods of measurement in support of project 7755, the Aeromedical Consultation Service (AFR 161-23), selected USAFSAM in-house research projects and those directed by higher headquarters, such as metabolic balance and drug evaluation studies. New equipment and techniques will be developed and validated with special emphasis on the assessment of clinical laboratory tests which indicate the risk of coronary artery disease in the USAF flying population. Integrated automated analyses, enzyme analyses, and hormonal assays will be emphasized.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0027, SAM CARDIOVASCULAR DISEASE FOLLOW-UP STUDY (WEST POINT)
J. WELLMAN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF318030)

Provide complete physical and laboratory examinations in a standardized environment to identify the earliest signs of occult or latent coronary artery disease and relate these to the 20 plus years of risk factor data which have been accumulated on this selected population. This information would be assimilated into refined selection and retention criteria for officer candidates in order to select and retain those least likely to suffer from premature cardiovascular disease.

Bring the subjects to the USAFSAM. At that time, perform a thorough examination to evaluate each subject's cardiovascular system and all risk factors, including all applicable medical and laboratory tests. Devote special attention to motivating subjects, both active and inactive, to participate in the study. Collate the data obtained from multivariate analysis of risk factors. Apply the results to the problems of (a) improved selection of candidates for pilot training and (b) early identification of individuals prone to heart disease. This work was previously documented under work unit 7930-07-05.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0028, EFFECTS OF INSPIRED GASES ON PULMONARY PATHOLOGY AND FUNCTION
R.J. KING, Univ. of Texas, School of Medicine, *San Antonio, Texas* 78284 (DF318650; F41609-75-C-0023)

In many Air Force operational environments personnel are required to breathe oxygen concentrations higher than that of air. Current diluter demand regulators normally supply 30 percent oxygen at ground level and some regulators supply as much as 40 percent oxygen at ground level, increasing to 100 percent oxygen with a safety pressure of 1 1/2 inches of water at 28,000 feet. Aircrews are exposed to 100 percent oxygen at ground level during prebreathing for certain reconnaissance flights. Navy pilots routinely use 100 percent oxygen at all flight altitudes. The use of elevated concentrations of oxygen is probably the most important single factor in the development of atelectasis in pilots of high-performance aircraft. Aviators breathing pure oxygen at reduced pressure are particularly susceptible to absorptional atelectasis and often experience it when airway obstruction occurs during exposure to acceleration. Exposure of man to pure oxygen even at normal atmospheric pressure rapidly alters lung function and may cause pulmonary damage. Variant partial pressures of oxygen, carbon dioxide and nitrogen may modify pulmonary cellular elements and surface active material, thereby degrading pulmonary function and increasing susceptibility to conditions such as respiratory infection, pulmonary atelectasis or other causes of impaired pulmonary gas exchange. The purpose of this effort is to attempt to define the mechanisms by which high oxygen concentrations affect the integrity and function of pulmonary tissues. Potential sites of morphologic or physiologic derangements in pulmonary tissues, resulting in degradation and progressive impairment of pulmonary function over the range of breathing mixtures encountered in the life support system design, will be determined, and protective measures to reduce potential pulmonary damage and impaired gas exchange in the lung will be developed.

The lung is comprised of over 40 different cell types and it has not yet been possible to differentiate direct effects of oxygen on the metabolism of surface active material for secondary effects resulting from other cellular damage and subsequent transudation into the alveolar space of fluids from the circulation or from damaged cells. Such fluids could interfere with the ability of surface active material to manifest its surface properties even though its own metabolism were unimpaired. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense - Air Force

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, ALGEBRAIC TESTS FOR FUNCTIONAL CONTROLLABILITY OF FUNCTIONAL DIFFERENTIAL EQUATION SYSTEMS
R. TRIGGIANI, Iowa State Univ. of Sc. & Tech, Univ. Press, *Ames, Iowa* 50010 (DF044060; AF-AFOSR-3038-76)

AF function - the flexibility available using digital computation has promoted the importance of the control system in determining overall system performance for modern Air Force systems. Deficiency - many of these systems have inherent time delays in their dynamics, and for these systems no methods exist in general for choosing an input so as to have the system track a desired output. Objective - the objective of this research is to determine under what conditions the above defined reproducibility problem can be approximately solved, forcing the output to be arbitrarily close to the prescribed function over a given interval. How work contributes - success here would provide more insight to the solution of an important class of Air Force problems.

The approach will be to reformulate the equation as an evolutionary equation in a suitable function space. This abstract operator characterization has already been shown by the author to be useful in treating partial differential equations (PDE's) and integral differential equations (IDE's) of volterra type. Now a unified mathematical treatment will be obtained which is applicable to functional differential equations (FDE's) as well.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0002, MICROWAVE PHYSICS MATH
UNKNOWN, R D P Incorporated, *Bedford, Massachusetts* 01713 (DF900200; F19628-75-C-0119)

AF function - target detection in clutter, missile reentry communications, electronic countermeasures. AWACS and advanced airborne national command post. Deficiency - electromagnetic scattering screens radar targets. Plasma sheath reflects rf signals in reentry vehicles. ICBM and ITBMS are vulnerable to ABM interceptors. AWACS and AABNCP communications can be interrupted by jamming signals. Objective - methods of target detection in clutter and methods of radar cross- section control. Characterization of plasma sheath and effects of chemical additives. Development of contiguous wideband frequency analyzers for threat signal acquisition. Design of frequency agile anti- jam system. How research contributes - establishes target scatter characteristics with and without clutter present and contributes to the design of ABM penetration aids.

Evaluation and reduction of data derived from measurements of mathematical models will aid in the solution of problems. The completed work is in the form of graphs, curves, tabulations or equations, suitable for computer processing. These results will be incorporated in the overall research effort of the laboratory in above mentioned problem areas.

ADDENDA: Supporting agency address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0003, DEVELOP & IMPLEMENT MATHEMATIC TECHNIQUES & COMPUTER ROUTINES TO ANALYZE DATA TELEMETERED FROM ROCKET PROBES REQUIRING PRECISE DETERMINATION
R.J. MARCOU, Boston College, School of Arts & Sciences, *Chestnut Hill, Massachusetts* 02167 (DF240840; F19628-73-C-0133)

AF function - communications, surveillance and navigation in the polar regions. Deficiency - lack of definitive knowledge of polar disturbed ionospheres for possible circumvention. Research - analysis of experimental data from polar rockets flown through various categories of disturbed ionosphere. How research contributes - augments knowledge on the prognostication of radio wave propagation in polar regions. Data collected from rocket flown experiments (e.g., probes of the electron and ion density, temperature, electron energy distribution, vehicle potential) in the d and e - ionospheric regions during disturbed conditions (e.g., polar ionosphere) are analyzed, resulting in the tabulation of the critical parameters from which advanced analysis can be made (along with plots and digital tapes of first-order data analysis).

Develop and implement computer routines and techniques for the continued reduction of raw digital data from transducer output requiring correlated sensor position vectors in their analysis.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory SU L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0004, NUMERICAL METHODS FOR PROBLEMS ON ENVIRONMENTAL EFFECTS IN AEROSPACE VEHICLES
R.S. VARGA, Kent State University, School of Arts & Sciences, *Kent, Ohio* 44242 (DF038960; AF-AFOSR-2729-74)

AF function - advanced aerospace vehicles need hardened electronic devices. Deficiency - no efficient techniques for analyzing the transient effects of electromagnetic pulses on the electronic devices in the vehicle. Objective - this research effort will study the solution of stiff differential equations such as those that arise in the analyses of electronic devices. How work contributes - this research may provide powerful approximation methods for solving ODE's.

Implicit Runge-Kutta methods for solving stiff ordinary differential equations will be studied. Stability properties of a subclass of these methods will also be studied. Numerical experiments involving implicit Runge-Kutta methods will be performed and evaluated. Rational approximations of EXP (-Z) which have poles outside an infinite sector will be investigated to determine their usefulness in the generation of numerical schemes for systems of ODE's. This research is a joint effort with Professor E. Saff/University of South Florida.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0005, MATRIX METHODS FOR SPECIAL FUNCTIONS ARISING IN APPLICATIONS

Y. IKEBE, Univ. of Texas, School of Arts & Sciences, *Austin, Texas* 78712 (DF041260; AF-AFOSR-2844-75)

The study of nuclear weapons effects on Air Force aerospace vehicles requires better knowledge of the particular effect of electromagnetic pulses on the vehicle structures and equipment. Such study requires the solution of many mathematical equations (i.e., Maxwell equations) by the use of both analytical and numerical methods. This proposal addresses some aspects of the problem described above. It intends to use the matrix approach to compute important quantities associated with so-called functions of mathematical physics. Problems like the zeros of the Bessel functions and the zeros of orthogonal polynomials are transformed into eigenvalue problems for certain tridiagonal matrices. The motivation for this approach is the existence of efficient matrix eigenanalysis subroutines (i.e., Eispack) to simplify the computation. This research effort will continue the investigations of the zeros of Bessel functions and their derivatives, the zeros of the regular Coulomb wave functions, and the characteristic values of the Mathieu equation. The investigation of various theoretical questions arising in connection with the matrix method as well as the extension of such method to include a wider class of special functions will be emphasized. In addition, various technical and experimental details leading to the development of efficient mathematical subroutines will be investigated.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0006, NUMERICAL TECHNIQUES FOR THE DESIGN OF AEROSPACE VEHICLES

A. MIELE, Rice University, Graduate School, *Houston, Texas* 77001 (DF033520; AF-AFOSR-2185-72)

The design of maneuvering energy vehicles is of interest to the space and missile systems organization and in fact to the entire Department of Defense and NASA. Successes in this area will provide the capability for terminal guidance and control reducing the requirement for more sophisticated initial and trajectory guidance. Nevertheless, this alternative approach introduces additional requirements for solution of problems in fluid flow, heat transfer, optimal path and flight control, among others. This research effort addresses some aspects of the stated problem area. The objective of this research is the development of effective numerical/computational methods for solving nonlinear (algebraic or transcendental) equations, nonlinear ODE's, mathematical programming problems, and optimal control problems. Specific areas of application are the numerical solution of optimal reentry trajectory and numerical solution of optimal aerodynamic shapes. Algorithms to be developed will be implemented and tested in an IBM 370/155 computer.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, LOW-ENERGY ATOMIC COLLISIONS

R.H. NEYNABER, Intelcom Rad. Technology, *San Diego, California* 92138 (DF030140; F44620-74-C-0002)

AF function - this research contributes to RO 6.1, Nuclear Weapons Effects. Deficiency - fireball codes require information on reaction rates for excited reactants and the kinetic and internal energy of the reaction products. Objective - to study selected reactions that will produce rewarding information on the kinetics of collisions and that can be expected to lead to general theoretical models. Contribution - useful information related to applications can be extracted from general theoretical models.

Merging beams and crossed beams apparati are used for investigation of two-body, inelastic reactions including the determination of cross sections and mechanisms for the transfer of translational and internal energy of reactants into translational and internal energy of products.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0002, EPITAXIAL GROWTH OF GE-GAAS

A.A. IMMORLICA, Rockwell International Corp., *Thousand Oaks, California* 91360 (DF044620; F44620-76-C-0134)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures, and communications systems. Opportunity - GaAs Impatt diodes are limited in their efficiency due to the fact that the same material is used in both the avalanche and drift regions of the device. An improvement in efficiency is possible by using a narrow bandgap material for the avalanche zone and a high-drift-velocity material in the drift region. Objective - the objective of this research is to solve the materials growth problems of Ge-GaAs heterojunctions by employing state-of-the-art liquid-phase epitaxy techniques. How work contributes - a properly grown heterojunction of this type with Ge (narrow bandgap) and GaAs (high velocity) promises to produce Impatt devices with efficiencies up to 25 percent greater than those of GaAs Read-type Impatts.

The main problem with liquid-phase epitaxy growth of a Ge-GaAs heterojunction is autodoping due to substrate dissolution. It has been found that the most critical factors influencing crystal formation v.s. autodoping by meltback of the substrate are the melt saturation conditions at the liquid-crystal interface and the thermal stability at this interface. The work proposed here will use a unique liquid-phase epitaxial system to grow Ge layers on GaAs substrates. This growth system is transparent so that one can observe the condition of the melt and experimentally determine the liquid's phase boundary as well as the degree of supersaturation of the melt. This system also includes a Ge source crystal in one pocket of the graphite platform. The Ge melt can then be precisely saturated by equilibrating the melt over the source crystal before commencing growth. A final feature of the system is the incorporation of a cold finger in intimate contact with the growth crucible. This cold finger can extract heat from the system and thus introduce a strong temperature gradient across the growth interface. This gradient increases the thermal stability at the interface and thus reduces the possibility of autodoping. The layers will be grown on both semi-insulating and conducting GaAs substrates. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0003, MOLECULAR DYNAMIC CALCULATION OF ENERGY TRANSPORT IN SOLIDS 12922-P

D. TSAI, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20324 (DA0Z5573)

To study the atomistic mechanism by which energy propagates in a solid or liquid when the system is subjected to thermal or mechanical excitation. The work is relevant to a number of Army problems including the response to shock and/or heating of energetic materials, propagation of flames and detonation, to the computer simulation of diffusion, calculation of thermal conductivity of solids in extreme pressure and temperature regions, treatment of grain boundaries.

The method of molecular dynamics will be used, taking a model for a solid to obtain the qualitative behavior of real

systems. For quantitative comparison, input from solid-state and lattice dynamical theories will be used.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

8.0004, ELECTRONIC STRUCTURE OF SOLIDS, SURFACES AND INTERFACES

A.B. KUNZ, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (DF043360; AF-AFOSR-2989-76)

AF function - Air Force functions such as communications, reconnaissance and surveillance, and command and control depend heavily upon modern electronic systems. Opportunity - improved performance in electronic systems can be achieved once a detailed and complete knowledge of electronic materials is available. Objective - to determine electronic structure, impurity states and surface properties of material with potential for improvement of current semiconducting devices. How work contributes - these studies will contribute to the understanding of the electronic properties of device materials and of the effects of impurities and their migration on these materials.

Unrestricted Hartree-Fock cluster calculational techniques will be used to study III-V binary, ternary and quanternary systems, the surface structure of simple metals, and semiconductors and their response to simple impurities.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0005, NONLINEAR MECHANICS OF UNSTABLE PLASMAS

H. LASHINSKY, Univ. of Maryland, Inst. For Fluid Dyn. & Math., *College Park, Maryland* 20742 (DF020740; AF-AFOSR-2179-72)

Air Force function - aerospace vehicles. Deficiency - knowledge of plasma resistivity pertaining to arc-heated plasma wind tunnels is largely based on overall current and voltage measurements which cannot provide spatial resolution, the use of trial functions to describe the temperature dependence of the conductivity. Also the physical theory of conductivity available is only valid for a range of plasma parameters such that the number of particles within a Debye sphere is large compared to 100, whereas the experimental conditions are such that this number is from 10 to 100. This poor state-of-the-art hampers rationally based design improvements of arc plasma gas heating devices. Objective - to make plasma conductivity measurements in the q-machine for parameter ranges that pertain to arc heaters for wind tunnels, as well as to reentry-generated shock layers, wakes and plumes. How contributes -measurements of conductivity can be made in the q-machine, using the newly devised measuring apparatus and technique, in which the number of particles within the Debye sphere can be matched to the values experienced in actual heaters. Then the effects of temperature and other variations can be observed. This will build up a basis for a more reliable theory which can be used in understanding how to make eventual improvements in arc heaters.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0006, INFRARED NONLINEAR OPTICS IN SEMICONDUCTORS

P.A. WOLFF, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF041830; AF-AFOSR-2894-76)

Secure space communications and covert optical electronics require devices which exploit special properties and interactions of materials with far-infrared and submillimeter waves. This region of the electromagnetic spectrum has been virtually unexplored for military communications in space and has advantages over microwave and visible optical communications in being secure from airborne and ground detection. This effort combines theory and experiment to investigate a variety of infrared nonlinear optical energy transfer processes in narrow band-gap semiconductors for generating coherent far-infrared tunable sources of radiation. The following nonlinear processes involving mobile and weakly bound electrons in semiconductors are being studied - resonant, spin-induced difference frequency generation, sideband generation via spin precession, radiation from parametrically excited plasma waves, resonant, stimulated impurity scattering, stimulated, far-infrared spin-flip scattering, resonant, field-induced nonlinearities due to impurities in specially prepared materials such as, In(Sb,Bi), (In,Tl)Sb, InSb CdTe and (HgCd)Te.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0007, INELASTIC PROCESSES IN ATOMIC COLLISIONS

M.E. RUDD, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (PHY76-23348)

A broad program of basic experimental atomic collisions measurements will be continued which involves ion-atom, atom-atom, and electron-atom collisions with specific emphasis in the following areas: A) Measurement of cross sections for the production of electrons and slow positive ions in collisions of ions, neutral atoms, and electrons with gaseous targets. B) Polarized photon-scattered atom/ion correlation measurements in He ion plus He and H ion plus Xe collisions will be extended. C) Measurement of the decay of negative-ion resonances will be continued by examining structure in the optical channel for various levels in N and He. Beam foil experiments will investigate the effect of a tilted foil in producing anisotropy in the excited atoms. An analysis of the polarization of the emitted radiation will allow conclusions concerning the alignment and orientation of the source atoms.

This work is a continuation of that currently supported under grant PHY73-04777 A02.

SUPPORTED BY U.S. Natl. Science Foundation

8.0008, SCHOTTKY BARRIER CONTACTS ON GAAS

B.P. JOHNSON, Univ. of Nevada, School of Engineering, *Reno, Nevada* 89507 (DF044310; AF-AFOSR-3053-76)

AF function - microwave solid-state electronic devices are essential components of Air Force communications and signal processing systems. Deficiency - at the present time ohmic contacts to GaAs exhibit specific contact resistances which vary by several orders of magnitude depending on the relative control of the several processing parameters. Better understanding and control over these parameters (such as time between cleaning and metallization, evaporation pumping time, relative vacuum, metallization alloy, etc.) are necessary in order to obtain consistant results with ohmic and non-ohmic contacts. Objective - the objective of this research is to obtain an understanding and control of Schottky barriers on GaAs by correlating processing parameters with measurements of the Schottky barrier characteristics. How work contributes - this work will contribute to the state-of-the-art in microwave technology by optimizing device performance as far as contacting is concerned and by indicating which device processing parameters have to be carefully controlled during the contacting process.

This research will address the problem of contacting on GaAs by considering those processing parameters related specifically to Schottky barriers on GaAs transferred electron devices. Schottky barrier height measurements will be made by capacitance-voltage and current-voltage techniques on metal-GaAs contacts prepared under varying conditions. Conditions will be changed by varying pre-evaporation chemical cleaning, by native oxide growth between etch and metallization, by the presence or lack of hydrocarbon contamination during evaporation, and by varying substrate temperature during evaporation. In addition, comparisons will be made between aluminum and gold barrier heights by looking at evaporation rate and vacuum pressure, metallization thickness, and metallization purity. In conjunction with the experimental work, a computer model of the theory of the role of surface state effects on Schottky barrier heights will be used to obtain reasonable estimates of surface state densities and interface thicknesses.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0009, ATOMIC AND MOLECULAR BEAM COLLISION AND POLARIZABILITY STUDIES 13365-P

B. BEDERSON, New York University, School of Arts & Sciences, *New York, New York* 10012 (DA0S5576; DAAG29 76 G0065)

To obtain measurements of the dc polarizability of neutral atoms and molecules, and on cross sections for electron-atom scattering for atoms in selected excited states. Relevance - Electric dipole moments of atomic and molecular species in collisions or interactions with electromagnetic fields are of importance to various aspects of upper atmospheric modeling, laser design, and excited-state chemistry. Reliable values for the polarization of most elements and molecules are presently unavailable. In addition, the cross sections for excited states are often orders of magnitude larger than for ground-state species. It is conceivable that these polarization and cross-section values could have a significant influence in a wide variety of atomic and molecular processes of military interest.

The dc polarizability will be obtained on atoms such as barium, calcium and strontium using the e-h balance technique. The use of dye laser-induced fluorescence will be investigated as a means of detecting elements and molecules in a beam for which standard surface ionization detection is not feasible. Tunable dye laser irradiation of atomic beams will be utilized to produce excited atoms for electron scattering measurements.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

8.0010, LASER PELLET PLASMAS FOR TAILORED X-RAY PLASMA

M.J. LUBIN, Univ. of Rochester, School of Engin. & Appl. Sci., *Rochester, New York* 14627 (DF026400; AF-AFOSR-2278-72)

AF function - considerable damage and incapacitation of equipment may result from a nuclear attack. The deleterious effects may be decreased and even eliminated by suitable protection. Deficiency - the design characteristics of protection devices are unknown today and as the SALT agreements prohibit nuclear tests these can be obtained only by simulation in the laboratory. Objective - this program is a continuation of effort toward (a) X-ray production and photo-excitation in laser- plasma and (b) X-ray lasing in laser-produced plasmas. It is both an experimental and theoretical research to develop basic instrumentation for understanding the physical processes which are responsible for the X-ray generation and to design a program for the eventual development of an X-ray laser. Contribution - this research is a part of a comprehensive program for the development of an X-ray source suitable for simulation of nuclear weapon effects.

Today little quantitative knowledge is available regarding the factors which influence the conversion efficiency of laser energy to X- rays. To improve the present situation considerable basic research is necessary for the conditions in the plasma and the mechanisms of the various processes. It is known that among the important mechanisms for the production of an X-ray excited state in a laser plasma are (a) photoexcitation and photoionization, (b) direct electron-collisional excitation, (c) radiative three-body recombination and (d) dielectric recombination. To obtain quantitative information on the foregoing theoretical and experimental investigations will be attempted. Specifically, this research will perform (a) high-power tailored laser pulse experiments with elongated targets of heavy element to study the spatially resolved X-ray spectrum, (b) experiments on compound targets to study the energy transfer processes for inversion investigations in the X-ray regime and (c) experiments to develop a time-resolved spectrum capability.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0011, FLUX PINNING AND CRITICAL CURRENTS IN A-15 SUPERCONDUCTORS

J.D. LIVINGSTON, General Electric Company, *Schenectady, New York* 12305 (DF040580; F44620-75-C-0044)

High-temperature superconducting materials are needed for application in airborne multimegawatt power generation and conditioning systems. Research specifically directed toward the synthesis and characterization of high-transition-temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. The performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators, transformers and induction energy storage systems could be significantly improved if the upper critical field, the current-carrying capacity and the critical transition temperature of the superconducting material could be enhanced. In addition, ac power distribution losses, transients and mechanical breakdown of the superconductor need to be reduced. This research involves the synthesis and preparation of binary and ternary A- 15 metallic compounds for the purpose of studying flux-pinning mechanisms in practical superconductors. The objective is to further the understanding of the relationships between processing variables, metallurgical microstructures, and the superconducting properties of A- 15 compounds such as Nb3Sn, V3Ga, and Nb3Ge. Emphasis is placed on multifilamentary and thin-film conductors.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0012, ION-IMPLANTED SEMICONDUCTORS AND SEMIINSULATORS

E.T. RODINE, Systems Research Labs. Inc., *Dayton, Ohio* 45432 (DF103520; F33615-72-C-1099)

AF function - surveillance, communication, target identification. Deficiency - present microwave devices have severe performance limitations at the higher microwave frequencies and require improved reproducibility and reliability. Research - study the doping of appropriate semiconductors or semiinsulators by ion implantation. Research is directed towards the understanding of the important parameters characterizing implantations such as the depth distribution and the lattice location of the implanted atoms, the amount of radiation damage and its annealing behavior and the electrical and optical properties of the implanted layer. How research contributes - many useful properties of semiconductors are largely dependent upon the successful incorporation of impurity dopants. Ion implantation provides an attractive doping technique for semiconductors. The technique of ion implantation has several advantages over the conventional doping techniques: (1) the number of implanted ions and their depth distribution can be controlled externally in-precise manner, (2) geometrical control of the implanted area can be attained. Specific applications of output from this research is expected to improve performance of microwave devices, solid-state optoelectronic devices.

Semiconductor single crystals are implanted with light or heavy ions in the energy range of 10 to 150kEv to a dose of 10 super 14 to 10 super 16 ions per cm super 2. (a) Channeling studies shall be made to measure the depth profile concentration and lattice location of the implanted ions and the distribution and character of ion-implantation- induced radiation damage, (b) optical studies shall be made on the materials before and after implantation, (c) electrical studies of the implanted layer shall be made.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0013, ANALYSIS OF COMBUSTION PLASMAS BY FOURIER SPECTROSCOPY

G. MUELLER, Univ. Energy Systems Inc., *Medway, Ohio* 45341 (DF043610; F44620-76-C-0102)

AF function - this proposed research primarily falls in the 7.5 research objective which deals with a broad spectrum of physical phenomena and techniques underlying lasers and other electrooptical devices utilizing coherent light, including the infrared,

visible and ultraviolet spectral regions. Electrooptical techniques are relevant to the AF functions of surveillance, reconnaissance, communication, command and control, and in particular this proposal would have an impact in IFF, intelligence collection and countermeasures. Deficiency - a continuing need exists to determine the positions, strengths, widths and shapes of the spectral lines of all atmospheric species as well as exhaust gases. This type of research has the potential of some excellent military applications such as IFF, the testing of alternate fuels, and in conjunction with a forward-looking Raman system, a highly sensitive long-range remote chemical alarm system. Objective - the objective is to make on-line measurements of vibrational and rotational emission spectra of gases. To accomplish this, the construction of a fast fourier spectrometer system will be done. How work contributes - the research is a part of a comprehensive program in optics.

The approach is to investigate the vibrational and rotational emission spectra by using Fourier spectroscopy. These vibrational and rotation emission spectra will be employed as a diagnostic tool for gas analysis. Using this method, an optical resolution of 0.1/cm is possible. In addition, highly resolved data will be obtained without the signal loss inherent with dispersive systems, and a broad spectrum of frequencies may be sampled simultaneously. Alternatively, ultra-high resolution may be traded off for comparatively high resolution of data acquired at extremely fast rates. In order to fully exploit the Fourier method in real-time field configurations, signal-averaging techniques will be employed. This signal averaging is to be accomplished by storing repetitive data seams in memory. Additional requirements for signal averaging to be done are nondestructive mathematical manipulation and retrieval of selected portions of the spectrum for analysis.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0014, CRYSTALLINE DEFECTS AND THEIR TRANSPORT IN ALKALI AZIDES 13059-P

A.L. LASKAR, Clemson University, School of Phy. Math. & Bio. Sc, *Clemson, South Carolina* 29631 (DA0G5574; DAHC04-75-G-0130)

The primary objective of this research will be towards basic understanding of ionic behavior of alkali azides and the determination of the extent to which this behavior influences the various rate processes and fast reactions. The precise measurements of defect properties and their transport in alkali azides provides information which is directly relatable to metastability. This should lead to development of techniques which will bring about increased safety and the ability to more reliably predict performance of munitions systems.

The following transport studies will be undertaken: self and impurity diffusion of cations and anions in pure and doped crystals; self diffusion of actions in excess pressure of nitrogen to look for effects due to non-stoichiometry; ionic conductivity and ionic thermocurrent measurements in pure and doped crystals.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, P.O. Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

8.0015, SOLID-STATE CHEMISTRY STUDIES BY NMR

P.P. MAHENDROO, Texas Christian University, School of Arts & Sciences, *Fort Worth, Texas* 76129 (P-451)

Lead fluoride has an orthorhombic structure which is reported to have a metastable phase transition to a cubic structure. The transition temperature determined by different workers ranges from 200 degrees C to about 400 degrees C. We have measured F19 spin-lattice relaxation at 60 MHz in the temperature range 20 degrees C to 500 degrees C and NMR line- width at 56.4 MHz in the temperature range - 20 degrees C to plus 200 degrees C in zone-refined polycrystalline PbF2 and a single crystal of PbF2, both having cubic structure, and in addition in optical-quality pure polycrystalline PbF2, quoted by the supplier to be of orthorhombic structure. The motional narrowing of the NMR line-width occurs above 50 degrees C in the samples having cubic structure and above 100 degrees C in the orthorhombic sample, whereas an earlier investigation reports line narrowing above -10 degrees C in a PbF2 sample presumed to be of orthorhombic structure. The activation energy and diffusion of F minus ions and orthorhombic to cubic phase transition are obtained using the temperature dependence of T1 and NMR line-width.

SUPPORTED BY Robert A. Welch Found. - Houston, Texas

8.0016, MICROSTRUCTURAL STUDIES OF HYDROGEN AND OTHER INTERSTITIAL DEFECTS IN BCC REFRACTORY METALS

S.C. MOSS, Univ. of Houston, School of Natural Sci. & Math., *Houston, Texas* 77004 (E(40-1)-5111)

The objective of the project is to study the interactions of hydrogen and other interstitial defects with their host bcc refractory metals to provide further insight into such topics as mechanical properties and embrittlement. These topics are intimately related to the strain fields associated with the defects singularly or in clusters. With X-rays we will study the lattice dynamics of vanadium as a function of hydrogen and of deuterium concentration, noting the differences between the two. These measurements will be made as a function of temperature to separate thermal (phonon) and static (interestitial displacement field) effects. Similar X-ray measurements will be made on Nb-H (O,N) and Ta-H (O,N) alloys. In these alloys we shall also study the intensities in the vicinity of the superlattice peaks reported in TEM studies to see if the indicated clustering is a thin-film or bulk- crystal effect.

In connection with our X-ray measurements on V-D, we will examine the system with neutron diffraction, to determine the Debye-Waller factor of the D atoms as a function of temperature. Neutron diffraction will also be used to study the defect displacement field in Nb-D crystals through measurement of elastic diffuse scattering, using a triple-crystal spectrometer operating in the elastic scattering mode (zero energy transfer) to filter out the phonons.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0017, VIBRATIONAL SPECTROSCOPY AT HIGH PRESSURE

W.F. SHERMAN, Univ. of London, *London, England, United Kingdom* (DA0C9456; DAERO 76 G0054)

Study on the lattice dynamics of crystals in a variety of systems as a function of pressure and temperature. Behavior near phase transitions is particularly important. New high-pressure cells for use in Raman and infrared spectroscopy are to be designed and constructed. Such cells will not contain diamond anvils/windows and we will attempt to extend the limit of pressure obtainable by less expensive materials. Such studies, techniques, and equipment have immediate application to a variety of current U.S. Army research interests in many areas including the fields of energetic materials and electronic materials. Additionally, a new and novel narrow-bandwidth filter, tunable over frequencies from the ir to uv, is to be used in this effort. The concept of this filter is in the process of review for assistance in patenting by the U.S. Navy. It appears to represent orders of magnitude improvement in detection of low-intensity lines, such as a Raman line, at frequencies very near a high-intensity line, such as a laser line. Further development and improvement of this device holds significant potential for U.S. Army's programs in camouflage detection, chemical and pollution detection, and in most research efforts involving laser spectroscopy.

Infrared and Raman studies are to be carried out over wide ranges of pressure and temperature on a variety of crystalline materials. High- pressure optical cells will be developed to extend where necessary the range of these experiments. The purpose of this work is to improve our understanding of intermolecular forces, molecular motion in solids, and the detailed mechanism of solid-solid phase changes.

ADDENDA: Supporting agency address is: DARCOM R&S Group (EUR), Box 65 FPO NY 09510

SUPPORTED BY U.S. Dept. of Defense - Army

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SATELLITE OBSERVATIONS OF EXTREME ULTRAVIOLET RADIATION 13706-GSX
C.S. BOWYER, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (DA0E9110; DAAG29 76 G0188)

To measure the intensity, spatial distribution and time variation of any electromagnetic radiation created in or impinging upon the Earth's upper atmosphere in the wavelength range 200-1200A. Wavelength resolution of 10A and a spatial resolution of 5 degrees are anticipated. Relevance - the research is relevant to the Army satellite program, SATFAL, geared to battle-field nuclear fallout prediction. Knowledge of natural EUV radiation in the upper atmosphere is necessary before ionization processes associated with nuclear events can be assessed and decision made relevant to Army offensive and defensive weapon systems.

A spectrometer will be constructed for flight on the Air Force space flight P78-1 in March 1978. The research covers the development of the instrument, its integration in the satellite and the analysis of the results.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

10.0002, SOLAR MAGNETIC FIELDS
S.F. MARTIN, Lockheed Aircraft Corporation, *Palo Alto, California* 94304 (DF240600; F19628-76-C-0044)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions. Objective - determine the effect of motions and magnetic fields on the solar atmosphere and how each contributes to the environment for solar activity. How research contributes - provides the physical knowledge necessary for a sound cause-and-effect prediction technique for solar- induced disruptions.

Observations will be made to establish the size and strength of magnetic elements and to determine spatial correlations between the magnetic and velocity fields in the atmosphere.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0003, THEORETICAL STUDIES IN GRAVITATION AND ASTROPHYSICS
R.V. WAGONER, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (PHY76-21454)

Investigations of the properties of the gravitational interaction and their significance in astrophysics initiated under NSF grant PHY74- 15524 A01 will be continued and extended. Topics to be investigated include: 1) theories of gravitation, 2) gravitational radiation, 3) compact astrophysical objects, and 4) cosmology.

Emphasis will be shifted somewhat from tests of theories to the calculation of gravitational radiation emitted by realistic astrophysical systems.

SUPPORTED BY U.S. Natl. Science Foundation

10.0004, SOME PROBLEMS IN THE LATE STAGES OF STELLAR EVOLUTION
R.P. KRAFT, Univ. of California, Lick Observatory, *Santa Cruz, California* 95060 (AST74-13717 A02)

Observations of stars in the North Galactic Polar Cap star field will be carried out. These data will provide values of Preston's element abundance indicator for the RR Lyrae variable stars under study. This indicator in turn will provide the ratio of iron to hydrogen in the stellar atmosphere. A spectral synthesis computer program will be used to determine actual elemental abundances, in particular, carbon and nitrogen. Efforts will be undertaken to confirm or deny the existence of a discernable elemental abundance gradient in the halo of our galaxy. More distant stars, beyond 25 kiloparsecs, will be studied to complete this project. These research efforts will lead to a better understanding of the production and distribution of the chemical elements in our galaxy.

This is a continuation of work previously supported by NSF grant AST 74-13717A01.

SUPPORTED BY U.S. Natl. Science Foundation

10.0005, X-RAY ENVIRONMENTAL LIMITS TO MILITARY SYSTEMS - SOFT X-RAY ASTRONOMY
G.G. FRITZ, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN480098)

Develop and fly advanced sensors to determine the X-ray background above the Earth's atmosphere (which limits the sensitivity of X-ray detection). Evaluate the effect of such background limitations for defense surveillance and for auroral monitoring intended for communication disturbance prediction. Determine the temporal, spatial and spectral variability of the background X-ray sources from such studies.

X-rays from space in the energy range 0.1 to 20 kEv are measured with detectors carried on sounding rockets and satellites. Results from these observations of both compact and extended sources of X-rays are analyzed. X-ray spectra and X-ray sky maps are compared with theoretical calculations.

ADDENDA: Supporting agency address is: Naval Research Laboratory (7000), Washington, D. C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0006, SUBMILLIMETER OBSERVATIONS OF EXTRAGALACTIC OBJECTS AND MOLECULAR CLOUDS
R.H. HILDEBRAND, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (AST76-18439)

Submillimeter observations of cold clouds will be carried out on extragalactic objects. In particular, sources with infrared peaks at or beyond 100 micrometers will be studied. The Cerro Tololo 4-meter telescope has been used for observations and the data will be reduced. Future observation will be carried out at the University of Hawaii's 2.24-meter telescope and elsewhere. The feasibility of such observations is indicated by recent 30-micrometer work at the University of Arizona's 1.5-meter telescope, using a radiometer of a new type designed especially for submillimeter measurements. The scope and accuracy of that work will be extended using telescopes of better resolution and light-gathering power.

SUPPORTED BY U.S. Natl. Science Foundation

10.0007, DYNAMICS OF THE SOLAR ATMOSPHERE
D.H. MENZEL, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (DF243240; F19628-75-C-0016)

AF function - communications, detection, tracking. Deficiency - inadequate precision of predictions of damaging sun-induced geophysical disturbances. Research - solar magnetohydrodynamics, the physical characteristics of the solar corona and spectra line formation in the solar chromosphere. How research contributes - development of accurate techniques for predicting these disturbances. Approach - these researches would include a study of the electromagnetic forces in the solar atmosphere. These forces are important. Precise evaluation of their effects requires application of magnetohydrodynamics, whose equations and boundary conditions are often hard to apply. Static or quasistatic forces represent an oversimplification of the problem.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0008, THEORETICAL ASTROPHYSICS AND COSMOLOGY
P. MORRISON, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (AST74-19213 A02)

A range of topics in theoretical astrophysics and cosmology will be studied. Problems to be covered include: 1) The study of spinars, with emphasis on the problem of the ejection of radiating objects; 2) The fluorescence theory of supernovae, in particular, studies of 'internal nebulae' and of the effect of supernova ionization events on the heating of the interstellar medium; 3) Modeling of some of the recently discovered galactic X-ray sources such as the 'X-ray bursters', globular cluster and transient X-ray sources; 4) Studies of collapsed objects, in particular, of properties of matter at high densities; 5) Examination of the properties of Seyfert galaxies, such as NGC 1275; and, 6) Further examination of tests of cosmological models bearing on the value of qo, galaxy formation and evolution, and related topics in physical cosmology.

Prior support was NSF Grant AST74-19213A1.

SUPPORTED BY U.S. Natl. Science Foundation

10.0009, STRUCTURE AND CONTENT OF GALAXIES AND CLUSTERS OF GALAXIES
H.J. ROOD, Michigan State University, School of Natural Sciences, *East Lansing, Michigan* 48824 (AST75-18667)

The body of knowledge on the physical properties of galaxies and clusters of galaxies is not complete. Spectroscopic and photographic data obtained at the Kitt Peak, Cerro Tololo, and Hale Observatories in the years 1972-75 will be reduced and interpreted. The investigations will include: (1) The derivation of rotation curves for SO galaxies and optical galaxies associated with extended double radio sources to investigate any relations which may exist between the internal kinematics of these objects, their morphology and interaction with nearby objects and the intergalactic medium. (2) Mapping of the outermost extensions of SO galaxies and optical galaxies associated with extended double radio sources. (3) A detailed analysis of the structure and dynamics of the cluster Abell 194 as well as the optical cluster object associated with the radio source 3C40. (4) Derivation of radial velocities for a homogeneous sample of galaxies from the Zwicky-Herzog cluster 16 in Field 158 to try to understand the actual spatial distribution of this apparent 'clustering.' (5) An analysis of the structure and dynamics of the cluster Abell 2199 for possible determination of its rotation, and a detailed study of the optical object associated with its radio sources 3C338.

SUPPORTED BY U.S. Natl. Science Foundation

10.0010, SOLAR POLARIZATION AT 9400 MHZ
M. ISHITSUKA, Geophysical Institute of Peru, *Lima, Peru* (DF246780; AF-AFOSR-2883-76)

AF function - solar and ionospheric forecasting. Deficiency - relationship between solar disruptions (and related emissions) and resulting ionospheric disturbances that adversely affect communications systems is not understood. Objective - to establish correlations between cause and effect to predict geophysical events. How research contributes - the suspected key in solar the degree and sense of polarization during bursts will add to interpretation of these events. This research must precede forecasting.

The group will make polarization measurements and investigate types of bursts where the sense of polarization changes during the burst, both impulsively and gradually. They will also correlate the time-intensity characteristics of polarized bursts at 9400 mHz with optical features in h-alpha observed concurrently at the institute.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH L.G. Hanscom AFB, Bedford, Mass. 01730. Performing organization: Instituto Geofisico del Peru, Lima, Peru.

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0011, PHOTOMETRIC AND SPECTROGRAPHIC INVESTIGATIONS OF DWARF CEPHEID VARIABLE STARS
D.H. MCNAMARA, Brigham Young University, School of Engin. Sci. & Tech., *Provo, Utah* 84602 (AST75-19751 A01)

This is the second and final year of a continuing grant, AST 75- 19751. Photometric and spectrographic studies are being carried out for several dwarf cepheid variable stars. The photometry will be secured in the uvby and khg photometric systems. The photometry will yield accurate information on color excesses, temperatures, surface gravities, and metal abundances of the stars. Spectroscopic observations of the stars will be secured to yield accurate velocity curves and mean velocities. The new data will be used in identifying the population type and evolutionary state of these important variable stars. The stellar masses and absolute magnitudes that can be derived from pulsation theory and observations should aid us in understanding the physical properties and evolutionary history of population II stars.

This is a continuation of work previously supported by NSF grant AST75-19751.

SUPPORTED BY U.S. Natl. Science Foundation

10.0012, HIGH-RESOLUTION SPECTROSCOPIC STUDIES IN AERONOMY
F.L. ROESLER, Univ. of Wisconsin, School of Natural Sciences, *Madison, Wisconsin* 53706 (ATM73-00374 A02)

This grant supports the analysis of data taken with the PEPSIOS Fabry-Perot spectrometer and some additional data taking for: 1. a study of the deuterium-to-hydrogen ratio on Jupiter and Saturn, which yields information about the formation and evolution of the solar system; 2. a study of the hydrogen abundance on Titan, to check on a recent study indicating puzzlingly large amounts of hydrogen there; 3. a high-resolution study of atmospheric sodium on Io, shown by previous investigations to extend for a considerable distance around Io; 4. a study of H2O ion lines from Comet Kohoutek, which may make it possible to get an upper limit on the Comet's H2O ion content.

This grant also supports some instrument-development work.

SUPPORTED BY U.S. Natl. Science Foundation

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N77-16982 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COLLECTED WORKS OF THEODORE VONKARMAN, 1952 - 1963
1975 393 p refs
Copyright. Avail: Advisory Group for Aerospace Research and Development, Paris

Scientific and technical writings by Von Karman, as well as those of transient or historical significance were collected from various journals and proceedings. Five of the papers reflect his interest in interdisciplinary studies concerned with magnetofluid-mechanics and aerothermochemistry. Editorial comments are presented as introductions to certain papers in order to relate the subject matter to the body of scientific and technical literature in the four volume compilation by Dr. Hugh Dryden. A.H.

N77-16983*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 77, DECEMBER 1976
Dec. 1976 91 p
(NASA-SP-7037(77)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 304 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1976. Author

N77-16984# Advisory Group for Aerospace Research and Development, Paris (France).
THE AGARD HISTORY, 1952 - 1975
1976 189 p
(ISBN-92-835-1206-5) Avail: NTIS HC A09/MF A01

The evolution of AGARD was presented from the year 1952 through 1975. S.M.

N77-16985# Advisory Group for Aerospace Research and Development, Paris (France).
DIRECTOR'S ANNUAL REPORT TO THE NORTH ATLANTIC MILITARY COMMITTEE, 1975
Mar. 1976 83 p
Avail: NTIS HC A05/MF A01

Agard publications for 1975 and abstracts of the publications by panel or activity are listed. Aerospace medicine, avionics, electromagnetic wave propagation flight dynamics, and guidance and control are several of the topics considered. S.M.

N77-16986*# Pratt and Whitney Aircraft, East Hartford, Conn.
AERODYNAMIC AND ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN EXHAUST NOZZLES Final Report
Hilary Kozlowski and Allan B. Packman Washington NASA Dec. 1976 141 p refs
(Contract NAS3-17866)
(NASA-CR-2628; PWA-5296) Avail: NTIS HC A07/MF A01 CSCL 01B

The static aerodynamic and acoustic characteristics of duct-burning turbofan (DBTF) exhaust nozzles are established. Scale models, having a total area equivalent to a 0.127 m diameter convergent nozzle, simulating unsuppressed coannular nozzles and mechanically suppressed nozzles with and without ejectors (hardwall and acoustically treated) were tested in a quiescent environment. The ratio of fan to primary area was varied from 0.75 to 1.2. Far field acoustic data, perceived noise levels, and thrust measurements were obtained for 417 test conditions. Pressure ratios were varied from 1.3 to 4.1 in the fan stream and from 1.53 to 2.5 in the primary stream. Total temperature varied from 395 to 1090 K in both streams. Jet noise reductions relative to synthesized prediction from 8 PNdB (with the unsuppressed coannular nozzle) to 15 PNdB (with a mechanically suppressed configuration) were observed at conditions typical of engines being considered under the Advanced Supersonic Technology program. The inherent suppression characteristic of the unsuppressed coannular nozzle is related to the rapid mixing in the jet wake caused by the velocity profiles associated with the DBTF. Since this can be achieved without a mecnanical suppressor, significant reductions in aircraft weight or noise footprint can be realized. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N77-16987 Georgia Inst. of Tech., Atlanta.
INSTABILITY OF NATURAL CONVECTION FLOW AROUND HORIZONTAL CYLINDERS Ph.D. Thesis
Kadry Ahmed Fathy Fathalah 1976 133 p
Avail: Univ. Microfilms Order No. 76-30420

The coupled Orr-Sommerfeld equations are derived and solved for air for Grashof numbers up to 4 x 10 to the 9th power, with the neutral stability curves determined. The favorite frequency band which the fluid amplifies most was found to vary, with variation of total Grashof number, cylinder radius, and kinematic viscosity. Experiments were carried out to check the analysis. A hot wire sensor was used to measure the basic temperature and velocity profiles. It was also used to detect temperature oscillations induced in the boundary layer. Neutral stability points were determined for different frequencies and found to agree well with the analytic results. Dissert. Abstr.

DATA SUMMARY: Data summary not prepared due to nonavailability of complete document for processing.

N77-16988# Wichita State Univ., Kans. Dept. of Aeronautical Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE AERODYNAMICS OF THE KLINE-FOGLEMAN AIRFOIL
Charles McFarland May 1976 66 p refs

(AR-76-5) Avail: NTIS HC A04/MF A01 CSCL 01A

Aerodynamics of the Kline-Fogleman airfoil were investigated with emphasis on the flow patterns of the airfoil and its performance in comparison to conventional delta wings. Smoke tunnel testing, two and three dimensional, flow visualization, and three dimensional force measurements were included. Results indicate that neither the flow patterns nor the performance of the Kline-Fogleman airfoil differ considerably from the conventional delta wing. Author

DATA SUMMARY: Aerodynamic characteristics of the Kline-Fogleman airfoil; variables include angle of attack, lift coefficient, drag coefficient, pitching moment coefficient, and lift/drag ratio; 4 figures include numeric data.

N77-16989*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THEORETICAL PARAMETRIC STUDY OF THE RELATIVE ADVANTAGES OF WINGLETS AND WING-TIP EXTENSIONS

Harry H. Heyson, Gregory D. Riebe, and Cynthia L. Fulton 14 Jan. 1977 74 p refs

(NASA-TM-X-74003) Avail: NTIS HC A04/MF A01 CSCL 01A

For identical increases in bending moment, a winglet provides a greater gain in induced efficiency than tip extension. Winglet toe angle allows design trades between efficiency and root moment. A winglet shows the greatest benefit when the wing loads are heavy near the tip. Washout diminishes the benefit of either tip modification, and the gain in induced efficiency becomes a function of lift coefficient; thus, heavy wing loadings obtain the greatest benefit from a winglet, and low-speed performance is enhanced even more than cruise performance. Both induced efficiency and bending moment increase with winglet length and outward cant. The benefit of a winglet relative to a tip extension is greatest for a nearly vertical winglet. Root bending moment is proportional to the minimum weight of bending material required in the wing; thus, it is a valid index of the impact of tip modifications on a new wing design. Author

DATA SUMMARY: Comparative aerodynamic efficiency and root bending moment calculations on wing designs with and without winglets and wing tip extensions; variables include potential flow efficiency factor ratio, root bending moment ratio, pressure distribution, leading edge sweep, degrees of washout, wing tip extension length, winglet length, bending material weight, Mach number, cant angle, aspect ratio; 41 figures and no tables include numeric data.

N77-16990*# Scientific Translation Service, Santa Barbara, Calif.

TRANSONIC ROTOR AERODYNAMICS: FUNDAMENTALS OF THE THEORY

W. H. Isay Washington NASA Feb. 1977 42 p refs Transl. into ENGLISH of "Transsonische Rotoraerodyn. Grundlagen einer Theorie", Inst. fuer Schiffbau der Hamburg Univ., West Ger., Rept-337, Feb. 1976 33 p

(Contract NASw-2791)

(NASA-TT-F-17395; Rept-337) Avail: NTIS HC A03/MF A01 CSCL 01A

A theory is developed in order to calculate the pressure distribution on the blades of a helicopter rotor in forward flight. Neglecting the influence of viscosity the velocity-potential is obtained as well as the pressure field wave equations with a nonlinear term. Following the theory of wave equations, the influence of accelerated moving shocks on the flow is represented by sink-distributions on the shock surfaces; similarly the loading and thickness-effects of the rotor blades are described by dipoles and source-sink-distributions on the foils. Author

DATA SUMMARY: No numeric data are presented.

N77-16991*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ESTIMATE OF CONJUGATE GAMMA AND GAMMA PRIME COMPOSITIONS IN Ni-BASE SUPERALLOYS

Robert L. Dreshfield 1977 31 p refs Presented at Workshop on Applications of Phase Diagrams in Metallurgy and Ceramics, Gaithersburg, Md., 10-12 Jan. 1977; sponsored by NBS

(NASA-TM-X-73576; E-9033) Avail: NTIS HC A03/MF A01 CSCL 11F

Approaches for estimating the composition of the matrix phase of alloys from the melt composition are reviewed. The first method is based on assigning essentially fixed stoichiometry to precipitating phases and is typified by PHACOMP. The second method uses analytical geometry to interpret phase diagrams and is applicable to a two-phase region of a six-component Ni-base system. The geometric method is also applicable to commercial Ni-base superalloys. Author

DATA SUMMARY: Chemical and phase compositions of nickel-base superalloys; variables include weight percent, atomic percent; 6 figures and 12 tables include numeric data.

N77-16992*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF TIP CLEARANCE ON OVERALL PERFORMANCE OF TRANSONIC FAN STAGE WITH AND WITHOUT CASING TREATMENT

Royce D. Moore and Walter M. Osborn Feb. 1977 26 p refs

(NASA-TM-X-3479; E-8945) Avail: NTIS HC A03/MF A01 CSCL 01A

The overall performance of a transonic fan stage is presented for various tip clearances, with and without casing treatment. The stage was tested with a solid casing, and with open skewed slots and closed skewed slots in the casing over the rotor blade tips. Four nominal nonrotating rotor blade tip clearances from 0.061 to 0.178 centimeter were used. For all three casings, the pressure ratio and efficiency decreased with increasing tip clearance. The stall margin for a given casing also decreased with increasing clearance. At design speed and a given tip clearance, the highest stall margin was obtained with the open-slot casing, and the lowest stall margin was obtained with the solid casing. Author

DATA SUMMARY: Effects of solid casing and porous casing on rotor blade tip clearances from 0.061 to 0.178 cm and on operating range (rotative speeds from 50 to 100 percent of design speed) of axial flow rotor; variables include rotative speed, airflow kg/sec, pressure ratio, temperature ratio, adiabatic efficiency, stall margin, flow path geometry; 6 figures and 3 tables include numeric data.

N77-16993*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

NUMERICAL SOLUTIONS OF NAVIER-STOKES EQUATIONS FOR THE STRUCTURE OF A TRAILING VORTEX

A. C. Jain Jan. 1977 66 p refs

(NASA-TM-X-73361) Avail: NTIS HC A04/MF A01 CSCL 01A

The structure and decay of a trailing vortex were analyzed during the numerical solutions of the full Navier-Stokes equations. Unsteady forms of the governing equations were recast in terms of circulation, vorticity, and stream function as dependent variables, and a second upwind finite difference scheme was used to integrate them with prescribed initial and boundary conditions. The boundary conditions at the outer edge and at the outflow section of the trailing vortex were considered. Different models of the flow were postulated, and solutions were obtained describing the development of the flow as integration proceeds in time. A parametric study was undertaken with a view to understanding the various phenomena that may possibly occur in the trailing vortex. Using the Hoffman and Joubert law of circulation at the inflow section, the results of this investigation were compared with experimental data for a Convair 990 wind model and a rectangular wing. With an exponentially decaying law of circulation at the inflow section and an adverse pressure gradient at the outer edge of the trailing vortex, solutions depict vortex bursting through the sudden expansion of the core and/or through the stagnation and consequent reversal of the flow on the axis. It was found that this bursting takes place at lower values of the swirl ratio as the Reynolds number increases. Author

DATA SUMMARY: Results of calculations for trailing vortices; variables include velocity, radius coordinates; 31 figures include numeric data.

N77-16994*# McDonnell-Douglas Corp., Long Beach, Calif.
A GENERAL METHOD FOR CALCULATING THREE-DIMENSIONAL COMPRESSIBLE LAMINAR AND TURBULENT BOUNDARY LAYERS ON ARBITRARY WINGS
Topical Report, Nov. 1973 - Mar. 1976
Tuncer Cebeci, Kalle Kaups, and Judy A. Ramsey Washington NASA Jan. 1977 87 p refs
(Contract NAS1-12821)
(NASA-CR-2777) Avail: NTIS HC A05/MF A01 CSCL 01A

The method described utilizes a nonorthogonal coordinate system for boundary-layer calculations. It includes a geometry program that represents the wing analytically, and a velocity program that computes the external velocity components from a given experimental pressure distribution when the external velocity distribution is not computed theoretically. The boundary layer method is general, however, and can also be used for an external velocity distribution computed theoretically. Several test cases were computed by this method and the results were checked with other numerical calculations and with experiments when available. A typical computation time (CPU) on an IBM 370/165 computer for one surface of a wing which roughly consist of 30 spanwise stations and 25 streamwise stations, with 30 points across the boundary layer is less than 30 seconds for an incompressible flow and a little more for a compressible flow. Author

DATA SUMMARY: Results of boundary layer calculations; variables include skin friction, displacement, thickness, velocity, wall shear parameter; 13 figures and 1 table include numeric data.

N77-16995*# DCW Industries, Sherman Oaks, Calif.
VORTICITY INTERACTION EFFECTS ON BLUNT BODIES
Final Report, 6 Jan. 1975 - 6 Jan. 1976
E. Clay Anderson and David C. Wilcox Washington NASA Jan. 1977 71 p refs
(Contract NAS1-13974)
(NASA-CR-2778; DCW-R-08-01) Avail: NTIS HC A04/MF A01 CSCL 01A

Numerical solutions of the viscous shock layer equations governing laminar and turbulent flows of a perfect gas and radiating and nonradiating mixtures of perfect gases in chemical equilibrium are presented for hypersonic flow over spherically blunted cones and hyperboloids. Turbulent properties are described in terms of the classical mixing length. Results are compared with boundary layer and inviscid flowfield solutions; agreement with inviscid flowfield data is satisfactory. Agreement with boundary layer solutions is good except in regions of strong vorticity interaction; in these flow regions, the viscous shock layer solutions appear to be more satisfactory than the boundary layer solutions. Boundary conditions suitable for hypersonic viscous shock layers are devised for an advanced turbulence theory. Author

DATA SUMMARY: Results of viscous shock layer calculations; variables include pressure, velocity, heating rate, eddy viscosity, shear stress, turbulent mixing energy; 16 figures include numeric data.

N77-16996*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT MEASUREMENTS OF LIFTING PRESSURES FOR A THIN LOW-ASPECT-RATIO WING AT SUBSONIC, TRANSONIC, AND LOW SUPERSONIC SPEEDS
Thomas A. Byrdsong Washington Feb. 1977 120 p refs
(NASA-TM-X-3405; L-10722) Avail: NTIS HC A06/MF A01 CSCL 01A

Pressure distributions in the form of differential pressure coefficients are presented for several wing chordwise and spanwise stations. Also presented are the results of limited analysis which show aircraft configuration effects, Mach number effects on the local wing loadings, comparisons of selected measured wing pressures with predicted pressures, and comparisons of wing loadings during right-turn and left-turn maneuvers. Author

DATA SUMMARY: Differential pressure distributions for several maneuver flight conditions as function of aircraft configuration and flight Mach number; the variables are wingbody combinations, wing-fuselage stores, control surfaces, fuselage geometry, Mach number, flight maneuvers, wing load distribution, and wing profiles; 24 figures and 2 tables include numeric data.

N77-16997*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SIDE FORCES ON A TANGENT OGIVE FOREBODY WITH A FINENESS RATIO OF 3.5 AT HIGH ANGLES OF ATTACK AND MACH NUMBERS FROM 0.1 TO 0.7
Earl R. Keener, Gary T. Chapman, Lee Cohen, and Jamshid Taleghani Washington Feb. 1977 114 p refs
(NASA-TM-X-3437; A-6609) Avail: NTIS HC A06/MF A01 CSCL 01A

An experimental investigation was conducted in the Ames 12-Foot Wind Tunnel to determine the subsonic aerodynamic characteristics, at high angles of attack, of a tangent ogive forebody with a fineness ratio of 3.5. The investigation included the effects of nose bluntness, nose strakes, nose booms, a simulated canopy, and boundary-layer trips. The forebody was also tested with a short afterbody attached. Static longitudinal and lateral-directional stability data were obtained at Reynolds numbers ranging from 0.3 mil. to 3.8 mil. (based on base diameter) at a Mach number of 0.25, and at a Reynolds number of 0.8 mil. at Mach numbers ranging from 0.1 to 0.7. Angle of attack was varied from 0 to 88 deg at zero sideslip, and the sideslip angle was varied from -10 to 30 deg at angles of attack of 40, 5[illegible], and 70 deg. Author

DATA SUMMARY: Diverse data are presented; variables include angle of attack, side-force coefficient, normal-force coefficient, pitching moment coefficient, yawing moment coefficient, hysteresis, Reynolds number, Mach number, roll angle of forebody, roll angle of nose tip section, and angle of sideslip.

N77-16998*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF RESET STATORS AND A ROTATING, GROOVED STATOR HUB ON PERFORMANCE OF A 1.92-PRESSURE-RATIO COMPRESSOR STAGE
George W. Lewis, Donald C. Urasek, and Lonnie Reid Washington Feb. 1977 93 p refs
(NASA-TM-X-3472; E-7947) Avail: NTIS HC A05/MF A01 CSCL 01A

The overall performance and blade-element performance of a transonic fan stage are presented for two modified test configurations and are compared with the unmodified stage. Tests were conducted with reset stators 2 deg open and reset stators with a rotating grooved stator hub. Detailed radial and circumferential (behind stator) surveys of the flow conditions were made over the stable operating range at rotative speeds of 70, 90, and 100 percent of design speed. Reset stator blade tests indicated a small increase in stage efficiency, pressure ratio, and maximum weight flow at each speed. Performance with reset stators and a rotating, grooved stator hub resulted in an additional increase in stage efficiency and pressure ratio at all speeds. The rotating grooved stator hub reduced hub losses considerably. Author

DATA SUMMARY: Improved stage efficiency at 70 and 90 percent of design speed for transonic fan with stator modifications; the variables are design blade-element parameters, design speed, blade edges, pressure ratio, equivalent weight flow (kg/sec), diffusion factor, loss coefficient, meridional velocity ratio, and suction-surface incidence angle; 10 figures and 11 tables include numeric data.

N77-16999*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF THE DEVELOPMENT OF DYNAMIC STALL BASED ON OSCILLATING AIRFOIL EXPERIMENTS
Lawrence W. Carr, Kenneth W. McAlister, and William J. McCroskey Washington Jan. 1977 104 p refs Prepared in cooperation with Army Air Mobility Lab, Moffett Field, Calif.
(NASA-TN-D-8382; A-6674) Avail: NTIS HC A06/MF A01 CSCL 01A

The effects of dynamic stall on airfoils oscillating in pitch were investigated by experimentally determining the viscous and inviscid characteristics of the airflow on the NACA 0012 airfoil

and on several leading-edge modifications. The test parameters included a wide range of frequencies, Reynolds numbers, and amplitudes-of-oscillation. Three distinct types of separation development were observed within the boundary layer, each leading to classical dynamic stall. The NACA 0012 airfoil is shown to stall by the mechanism of abrupt turbulent leading-edge separation. A detailed step-by-step analysis of the events leading to dynamic stall, and of the results of the stall process, is presented for each of these three types of stall. Techniques for flow analysis in the dynamic stall environment are discussed. A method is presented that reduces most of the oscillating airfoil normal force and pitching-moment data to a single curve, independent of frequency or Reynolds number. Author

DATA SUMMARY: The effect of the leading-edge separation bubble vis-a-vis trailing-edge boundary layer separation in the development of dynamic stall on an oscillating airfoil; variables include angle of attack, normal force, pitching moments, frequency, Reynolds number, oscillation amplitude, flow reversal point; 45 figures and 2 tables include numeric data.

N77-17000*# Boeing Commercial Airplane Co., Seattle, Wash.
SUPERSONIC PRESSURE MEASUREMENTS AND COMPARISON OF THEORY TO EXPERIMENT FOR AN ARROW-WING CONFIGURATION
Marjorie E. Manro Nov. 1976 700 p refs
(Contract NAS1-14141)
(NASA-CR-145046; D6-44224) Avail: NTIS HC A99/MF A01 CSCL 01A

A wind tunnel test of an arrow-wing-body configuration consisting of flat and twisted wings, as well as leading- and trailing-edge control surface deflections, was conducted at Mach numbers from 1.54 to 2.50 to provide an experimental pressure data base for comparison with theoretical methods. Theory-to-experiment comparisons of detailed pressure distributions were made using a state-of-the-art inviscid flow, constant-pressure-panel method. Emphasis was on conditions under which this theory is valid for both flat and twisted wings. Author

DATA SUMMARY: Diverse data are presented; variables include Mach number, dynamic pressure, angle of attack, normal force coefficient, pitching moment coefficient, trailing edge deflection, leading deflection, upper surface pressure coefficient, and lower surface pressure coefficient.

N77-17001*# Boeing Vertol Co., Philadelphia, Pa.
WIND TUNNEL TEST ON A 1/4.622 FROUDE SCALE, HINGELESS ROTOR, TILT ROTOR MODEL, VOLUME 1
J. P. Magee and H. R. Alexander Sep. 1976 779 p refs 4 Vol.
(Contract NAS2-9015)
(NASA-CR-151936; D238-10000-1-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 01A

Wing tunnel test data on a 1/4.622 Froude scale, hingeless rotor, tilt rotor mode are reported for all potential flight conditions through hover and a wide envelope of transitions. A mathematical model was used to describe the rotor system in real time simulation by means of regression analyses. Details of the model, test program and data system are provided together with four data files for hover and transition. Author

DATA SUMMARY: Diverse data are presented; variables include parametric force, moment and blade fatigue loads, flight range, airspeed, aircraft attitude, rotor control inputs, wing flap deflection, thrust loads and rotor RPM.

N77-17002*# Boeing Vertol Co., Philadelphia, Pa.
WIND TUNNEL TEST ON A 1/4.622 FROUDE SCALE, HINGELESS ROTOR, TILT ROTOR MODEL, VOLUME 2
J. P. Magee and H. R. Alexander Sep. 1976 679 p 4 Vol.
(Contract NAS2-9015)
(NASA-CR-151937; D238-10000-2-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 01A

Experimental transition data files from a wind tunnel test on a 1/4.622 Froude scale hingeless rotor, tilt rotor model are reported. Author

DATA SUMMARY: Diverse data are presented; variables include parametric force, moment and blade fatigue loads, hovering to low speed flight, aircraft attitude, rotor control inputs, wing flap deflection, thrust load, and rotor RPM.

N77-17003*# Boeing Vertol Co., Philadelphia, Pa.
WIND TUNNEL TEST ON A 1/4.622 FROUDE SCALE, HINGELESS ROTOR, TILT ROTOR MODEL, VOLUME 3
J. P. Magee and H. R. Alexander Sep. 1976 769 p 4 Vol.
(Contract NAS2-9015)
(NASA-CR-151938; D238-10000-3-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 01A

For abstract, see N77-17002.

DATA SUMMARY: Diverse data are presented; variables include parametric force, moment and blade fatigue loads, hovering to low speed flight, aircraft attitude, rotor control input, wing flap deflection, thrust load, and rotor RPM.

N77-17004*# Boeing Vertol Co., Philadelphia, Pa.
WIND TUNNEL TEST ON A 1/4.622 FROUDE SCALE, HINGELESS ROTOR, TILT ROTOR MODEL, VOLUME 4
J. P. Magee Sep. 1976 568 p 4 Vol.
(Contract NAS2-9015)
(NASA-CR-151939; D238-10000-4-Vol-4) Avail: NTIS HC A24/MF A01 CSCL 01A

Experimental cruise flight data files from a wind tunnel test on a 1/4.622 Froude scale hingeless rotor, tilt rotor model are reported. Author

DATA SUMMARY: Diverse data are presented; variables include parametric force, moment and blade fatigue loads, cruising flight speed, aircraft attitude, rotor control input, wing flap deflection, thrust load, and rotor RPM.

N77-17005*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
ROLLING MOMENTS IN A TRAILING VORTEX FLOW FIELD
Final Report
Oden J. McMillan, Richard G. Schwind, Jack N. Nielsen, and Marnix F. E. Dillenius Feb. 1977 148 p refs
(Contract NAS2-9398)
(NASA-CR-151961; NEAR-TR-129) Avail: NTIS HC A07/MF A01 CSCL 01A

Pressure distributions are presented which were measured on a wing in close proximity to a tip vortex of known structure generated by a larger, upstream semispan wing. Overall loads calculated by integration of these pressures are checked by independent measurements made with an identical model mounted on a force balance. Several conventional methods of wing analysis are used to predict the loads on the following wing. Strip theory is shown to give uniformly poor results for loading distribution, although predictions of overall lift and rolling moment are sometimes acceptable. Good results are obtained for overall coefficients and loading distribution by using linearized pressures in vortex-lattice theory in conjunction with a rectilinear vortex. The equivalent relation from reverse-flow theory that can be used to give economic predictions for overall loads is presented. Author

DATA SUMMARY: Diverse data are presented; variables including rolling moment coefficient, lift coefficient, pressure coefficient, span loadings, radial distance from vortex centerline, and vortex velocity.

N77-17006# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
THE DOMAINS OF INFLUENCE AND OF DEPENDENCE IN EXPANDING AND COMPRESSING SUPERSONIC FLOWS
T. P. M. Hendriks Sep. 1975 28 p refs
(VTH-206) Avail: NTIS HC 103

A distinction is made as to (a) uniform parallel flow, (b) flow containing an oblique shock, and (c) flow containing a Prandtl-Meyer expansion. In the flows under (a) and (b) the domains can easily be described quantitatively. In the flow containing a Prandtl-Meyer expansion, the calculation presents some complications. These are solved using a bicharacteristic method given by Oswatitsch. Author (ESA)

DATA SUMMARY: No numeric data are presented.

N77-17007# Institut Franco-Allemand de Recherches, St. Louis (France).
AEROBALLISTIC INVESTIGATIONS IN THE CLASSICAL ISL BALLISTIC TUNNEL [SUR LES ETUDES D'AEROBALISTIQUE MENEES AU TUNNEL DE TIR CLASSIQUE DE L'ISL]
M. Giraud 28 Apr. 1976 35 p refs In FRENCH
(ISL-R-111/76) Avail: NTIS HC A03/MF A01

A survey is presented of the application of the ISL ballistic range to several ballistic problems mainly concerning projectiles during the past 15 years. ESA

DATA SUMMARY: Flow visualization and radar imaging techniques for determining aeroballistic characteristics of various projectiles; variables include ballistic velocity, center of gravity, incidence, deceleration, projectile surface properties, projectile stabilization, boundary layer transition, Reynolds number, and projectile profile. 16 figures and no tables include numeric data.

N77-17008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Zentralabteilung Niedergeschwindigkeits-Windkanaele
FLOW EFFECTS AT CROSS BLOWN LIFTING JETS OF V/STOL AIRCRAFT AND THEIR REACTION ON AERODYNAMIC FORCES AND MOMENTS OF THE NACELLE Ph.D. Thesis - Tech. Hochschule, Aachen
Guenter Viehweger 9 Jul. 1976 114 p refs In GERMAN; ENGLISH summary
(DLR-FB-76-34) Avail: NTIS HC A06/MF A01; DFVLR, Cologne, DM 44.80

Systematic basic studies on the near and far effects of cross blown single and twin lifting jets were performed with the aid of a principle model. The different effects are described in detail. The number of the experimental parameters was reduced to the most essential ones: angle of attack, flight and the jet velocities as well as the jet diameter, distance between the twin jets, location of the wing relative to the jets and the fuselage, and ground distance. Emphasis is on the results of systematic pressure distribution measurements on the fuselage surface, especially in the close vicinity of the jet exits. From these results functions on the influence of the parameters were deduced. Author (ESA)

DATA SUMMARY: Pressure distribution effects on fuselage surface in vicinity of jet exists; variables include angle of attack, flight velocity, jet flow velocity, jet diameter, wing-fuselage configuration, ground distance; 79 figures and no tables are included.

N77-17009# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
ON TRANSONIC SHOCK-NONSEPARATING TURBULENT BOUNDARY LAYER INTERACTION IN TWO-DIMENSIONAL CHANNELS Interim Progress Report
A. Kluwick and G. R. Inger Jul. 1976 42 p refs
(Contract N00014-75-C-0456)
(AD-A028870; VPI-Aero-047) Avail: NTIS HC A03/MF A01 CSCL 20/4

The flow model of Inger and Mason for the interaction of a weak normal shock with a turbulent non-separating boundary layer along a flat plate in an unbounded stream is generalized to the channel flow case. The understanding of such internal flows is highly important not only for the design of turbo-machines but also for comparison of theoretical results obtained under the assumption of an unbounded stream with data resulting from channel flow experiments. The present study deals in particular with the change of the upstream decay rate of the pressure disturbances due to the effect of wave reflections within the channel and the change of the pressure level in this region. GRA

DATA SUMMARY: No numeric data are presented.

N77-17010# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ANALYTICAL DETERMINATION OF THE AIRFLOW RATE THROUGH A VENTURI AT LOW SUBSONIC MACH NUMBER Final Report, Feb. 1974 - Mar. 1975
Franz J. Huber, Thomas M. Weeks, and Gregory Powers May 1976 36 p refs
(AF Proj. 1988)
(AD-A029025; AFFDL-TR-76-26) Avail: NTIS HC A03/MF A01 CSCL 20/4

Because the experimental determination of the air mass flow coefficient for a large venturi is very cumbersome, time consuming and costly, an analytical method was developed which yields a high accuracy, within + or - 1/2 percent. With this method, the air mass flow through a subsonic venturi is calculated from the total pressure and temperature and the throat wall static pressure whereby the mass flux variation across the throat, the real gas properties and the boundary layer in the throat are considered. For a specific venturi of 5/8 inch throat diameter, operated at high pressure, the calculating method and the resulting mass flow coefficient are presented. This method, including a computer program to calculate the flow field through the venturi, can conveniently used to determine the flow coefficient for an arbitrary venturi contour. Author (GRA)

DATA SUMMARY: Overall mass flow coefficient for sample venturi was calculated; variables include radius, ft/sec, Mach number at throat tap location, discharge coefficient, atmospheres, and pressure; 6 figures include numeric data.

N77-17011# Winzen Research, Inc., South St. Paul, Minn.
POLYETHYLENE BALLOON REEFING SLEEVE SYSTEM Final Report, 15 Dec. 1974 - 15 May 1976
P. Osborne 15 May 1976 9 p
(Contract F19628-75-C-0111; AF Proj. 6665)
(AD-A028056; AFGL-TR-76-0123) Avail: NTIS HC A02/MF A01 CSCL 01/3

Modification to balloon model no. SFN-217.7-060-NSC-01VL to incorporate redesigned reefing sleeve and destruct device systems. During balloon inflation and launching, ground winds can cause the uninflated balloon material to form a sail which will cause overstressing of the balloon envelope. The reefing sleeve concept, further developed under this contract, provides a means of controlling the material deployment during these critical early stages of a balloon flight. Author (GRA)

DATA SUMMARY: No numeric data are presented.

N77-17012# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
THE DESIGN OF A TWO-DIMENSIONAL, HIGH-ENDURANCE AIRFOIL WITH A GIVEN THICKNESS DISTRIBUTION AND REYNOLDS NUMBER Final Report
Douglas A. Lien Jun. 1976 77 p
(AD-A027968; AERO-1221; DTNSRDC-76-0015) Avail: NTIS HC A05/MF A01

A design procedure has been developed for determining the shape of a high-endurance airfoil for a given initial thickness distribution and chord length Reynolds number. The Strand method, which is based on the Stratford theory of incipient separation and the optimization principle of the calculus of variations, was utilized to yield an optimized velocity distribution. A generalized parametric study of the upper surface velocity, lift, and drag characteristics for various flow conditions resulted in a series of preliminary design curves. A practical set of performance characteristics based on these parametric curves led to a reasonable airfoil shape. GRA

DATA SUMMARY: Aerodynamic characteristics of different airfoil configurations; variables include lift drag ratio, lift coefficient, angle of attack, form factor; 10 figures include numeric data.

N77-17013# Forge Aerospace, Inc., Washington, D.C.
ADDITIONAL RESEARCH ON AN AUTOMATIC AIR VALVING SURFACE EFFECTS DEVICE (AAUSED) Final Report, Jun. 1975 - Jul. 1976
Carl W. Messinger, Jr. and John W. Stone Jul. 1976 202 p refs
(Contract DAAG53-75-C-0226; DA Proj. 1G7-63726-DG-1407)
(AD-A028941; DAAG53-C-75-0226-001) Avail: NTIS HC A10/MF A01 CSCL 01/1

Theoretical analysis of the AAUSED concept for air cushion vehicles was conducted. The results are presented in the form of parametric design curves, by which the characteristics of devices suitable for specific operational requirements could be determined. Laboratory tests of scale model devices were conducted to validate the analysis and/or to determine empirical adjustments to the design curves. Additional research is recommended, specifically to investigate the flow through the valve system and to define the pressure loss characteristics. GRA

DATA SUMMARY: Diverse data are presented; variables include base pressure, power, lift coefficient, pressure ratio, power coefficient, dimensionless centerline height, dimensionless tension, elongation, diaphragm profile, and stress.

N77-17014# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF A HIGH/LOW Q AIRCRAFT RECOVERY PARACHUTE SYSTEM Final Report, Nov. 1972 - Nov. 1973
Daniel J. Kolega Feb. 1976 177 p
(AD-A029270; ASD-TR-76-4) Avail: NTIS HC A09/MF A01 CSCL 01/3

Various concepts were studied for providing a high/low q recovery parachute to recover aircraft in uncontrollable maneuvers at both high and low dynamic pressure. Fixed time delay skirt reefing was selected and a packing investigation was conducted to determine if it is possible to install such a parachute system in existing spin recovery parachute compartments. Finally, a wind tunnel test program was conducted to determine the feasibility of reefing spin recovery parachutes to extend their performance range. Throughout all tests a positive force held the chute outstretched in the wake of the spinning aircraft model demonstrating the feasibility of the reefing concept. The technology gained from this effort is applicable to most new aircraft systems (as the F-15, F-14, F-5, and lightweight fighters), and could permit more extensive and safer flight testing at high speed near stall conditions. GRA

DATA SUMMARY: Diverse data are presented; variables include spin stabilization, dynamic pressure effect, drag force, inflation time, aerodynamic load, structural design criteria, aircraft velocity, angle of attack, roll angle, riser length, tunnel velocity, suspension line length, and electronic drive system speed.

N77-17015# Martin Marietta Labs., Baltimore, Md.
INTEGRATION OF THE 3-D HARMONIC KERNEL Interim Report
Peter F. Jordan Jun. 1976 24 p refs
(Contract F44620-73-C-0041; AF Proj. 9781)
(AD-A029550; MML-TR-76-46C; AFOSR-76-0948TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

Currently, the singular integral that arises in the analysis of oscillating lifting surfaces is evaluated by approximate methods, and considerable scatter exists between the results of different methods. In this paper, the application of an accurate approach to the Falkner finite element method is described, and some numerical results are compared with two current levels of approximation. Analytical difficulties that remain to be resolved are briefly discussed. Author (GRA)

DATA SUMMARY: No numeric data are presented.

N77-17016# ARO, Inc., Arnold Air Force Station, Tenn.
COMPARISON OF TWO METHODS USED TO MEASURE AERODYNAMIC LOADS ACTING ON CAPTIVE STORE MODELS IN WIND TUNNEL TESTS Final Report, Apr. 1973 - May 1976
R. E. Dix Sep. 1976 262 p refs
(AF Proj. 2567; ARO Proj. PF419)
(AD-A030208; ARO-PWT-TR-76-55; AEDC-TR-76-122) Avail: NTIS HC A12/MF A01

In a series of wind tunnel tests, measurements were made of the aerodynamic loads acting on eight different store configurations supported in and near the external captive position on a 1/20-scale model of the F-4C aircraft. Store models included blunt and contoured afterbody shapes, stable and unstable configurations, and large (pylon-mounted) and small (rack-mounted) configurations. Six components of forces and moments were measured using two methods of supporting the store models: an internal bracket support technique (IBS), and a dual sting support technique. Some characteristics of the interference flow field of the aircraft were also inferred. GRA

DATA SUMMARY: Aerodynamic forces and moments acting on store models were measured; variables include Mach number, wall porosity, normal force coefficient, side force coefficient, axial force coefficient, rolling moment coefficient, pitching moment coefficient, yawing moment coefficient, and distance; 51 figures include numeric data.

N77-17017# Air Force Geophysics Lab., Hanscom AFB, Mass.
RECENT PROGRESS IN BALLOON FILM RESEARCH (1965-1975)
Kozo Kawada 28 Jun. 1976 23 p refs Transl. into ENGLISH from Tokyo Daigaku Uchu Koku Kenkyujo Hokoku (Tokyo), v. 11; no. 2B, 1975 p 425-433
(AF Proj. 6665)
(AD-A030330; AFGL-TR-76-0134; AFGL-Trans-107) Avail: NTIS HC A02/MF A01 CSCL 11/9

Ten years of research in the field of balloon film materials are reviewed. For simplicity, only essential details of the work are given and only the barest outlines of published papers are included. The zero-pressure free balloon is given prime consideration and the remarkable progress in controlling the mechanical properties of polyethylene to achieve improved balloon performance is discusssed. Author (GRA)

DATA SUMMARY: No numeric data are presented.

N77-17018# Naval Postgraduate School, Monterey, Calif.
IN-LINE AND TRANSVERSE FORCES ON SMOOTH AND SAND-ROUGHENED CYLINDERS IN OSCILLATORY FLOW AT HIGH REYNOLDS NUMBERS Interim Report, Feb. - Jun. 1976
Turgut Sarpkaya 4 Jun. 1976 72 p refs
(Grant NSF AG-477)
(AD-A030403; NPS-69SL76062) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report presents the results of an extensive experimental investigation of the in-line and transverse forces acting on smooth and sand-roughened circular cylinders placed in oscillatory flow at Reynolds numbers up to 1,500,000, Keulegan-Carpenter numbers up to 100, and relative sand-roughnesses from 1/800 to 1/50. The drag and inertia coefficients have been determined through the use of the Fourier analysis and the least-squares method. The transverse force (lift) has been analysed in terms of its maximum, semi peak-to-peak, and root-mean-square values. In addition, the frequency of vortex shedding and the Strouhal number have been determined. The results have shown that (a) for smooth cylinders, all of the coefficients cited above are functions of the Reynolds and Keulegan-Carpenter numbers, particularly for Reynolds numbers larger than about 20,000; (b) for rough cylinders, the force coefficients also depend on the relative roughness k/D and differ significantly from those corresponding to the smooth cylinder; and that (c) the use of the 'frequency parameter' D sq/nu T and the roughness Reynolds number U sub m k/nu allow a new interpretation of the present as well as the previously obtained data. GRA

DATA SUMMARY: Results of studies of circular cylinders in oscillating flow; variables include drag coefficient, inertia coefficient, iift coefficient roughness, Reynolds number, Keulegan-Carpenter number, frequency; 36 figures include numeric data.

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N77-17019# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
SAFETY OF TRANSPORT AIRCRAFT Final Report, 1 Jun. 1974 - 30 Nov. 1975
Horst Grieser, Hans-Joerg Hertweck, Roland Keppeler, Hans-Joachim Koehler, Wolfgang Koehler, Gerd Lowak, Konrad Steininger, Josef Thomas, and Heinz Winter Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1976 356 p refs In GERMAN; ENGLISH summary Prepared jointly with DFVLR, Cologne
(Contract BMFT-LFF-27)
(BMFT-FB-W-76-07) Avail: NTIS HC A16/MF A01; ZLDI, Munich, DM 74.35

The main subjects investigated are: investigations on accidents and incidents, operational considerations of the terminal control area (conventional landing and take-off procedures and proposals for modified and new procedures), analysis of the landing procedures by consideration of pilot handling, and proposals for improving the safety in the terminal control area. Author (ESA)

N77-17020# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
GENERAL AVIATION ACCIDENTS INVOLVING AEROBATICS, 1972 - 1974
20 Jul. 1976 102 p
(PB-257747/6; NTSB-AAS-76-4) Avail: NTIS HC A06/MF A01 CSCL 01B

There were 105 accidents involving aerobatics which occurred in various small, fixed wing, U.S. general aviation airplanes during the period 1972 through 1974. Detailed statistical information is given regarding the number of injuries, kind of flying, type of accident, accident causes, and pilot experience. The adequacy and applicability of airworthiness standards relating to aerobatic certification, the fundamental importance of proper aerobatic training and orientation, and regulatory controls applicable to airshows was evaluated. GRA

N77-17021# Mitre Corp., Bedford, Mass.
MAC AIR CARGO DATA ENTRY: 1. PRELIMINARY ANALYSIS OF ALTERNATIVE MODES
S. L. Smith Aug. 1976 46 p refs
(Contract F19628-76-C-0001; AF Proj. 515B)
(AD-A029013; MTR-3066-Vol-1; ESD-TR-76-162-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report discusses means of facilitating the entry of shipping data about cargo unloaded at the truck docks of MAC air cargo terminals. Use of a portable handheld keypad/display device for on-line entry to a computer would seem to promise improvements in data handling. Several off-line modes might also prove useful for this application, including digital recording, image capture by photography or video techniques, and use of a manual checksheet. A test program is recommended to determine which of these alternative data entry modes warrant further consideration. Author (GRA)

N77-17022# IIT Research Inst., Chicago, Ill.
IDENTIFICATION OF CRITICAL FAILURES AND COST EFFECTIVE RELIABILITY IMPROVEMENT APPROACHES Final Report, Jul. 1975 - Apr. 1976
Kent J. Kogler Jun. 1976 77 p
(Contract DAAJ01-75-C-1087)
(AD-A028333; IITRI-E6338-FR; DRSAV-TR-76-26) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report represents the results of an analysis to identify safety critical items in Cargo, Utility and Attack helicopters. Included in the report is a detailed failure mode analysis which quantitatively identifies critical modes of failure (both hardware and human) whose occurrence (singly or in combination) can cause hazard in flight. The identified failure modes are ranked in terms of criticality. Improvement recommendations are made and a method is developed to assess their cost effectiveness. Improvement recommendations are ranked in terms of cost effectiveness. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N77-17023# ASE, Inc., Pennsauken, N.J.
RADIO REMOTE CONTROL SYSTEM FOR VISUAL NAVIGATION AIDS Final Report
Robert W. Harralson Jul. 1976 106 p
(Contract DOT-FA74WA-3433)
(AD-A031879; FAA-RD-76-42) Avail: NTIS HC A06/MF A01 CSCL 17/7

An evaluation unit to prove the feasibility and reliability of radio remote control for airport visual NAVAIDS is presented. Reliability includes radio link dependability, equipment dependability, and message security. The radio link is assured by directional antennas and large power margin; the equipment is designed to MIL Standards, and the message is triple encoded. The half duplex system is so formated that only one station transmits or receives at any one time. This combination insures that the messages will be successfully communicated without inter-station interference, in the noisy EMI environment of the airport, and through unfavorable conditions of terrain and weather. Author

N77-17024# New York State Dept. of Motor Vehicles, Albany.
LORAN-C CONCEPTUAL ANALYSIS Final Report, Jul. 1975 - Jun. 1976
Jul. 1976 89 p refs Prepared in cooperation with Polhemus Navigation Sciences, Inc., Burlington, Vt.
(Contract DOT-HS-5-01234)
(PB-258251/8; DOT-HS-801-952) Avail: NTIS HC A05/MF A01 CSCL 17G

Terrestrial applications of LORAN-C are investigated with respect to operational, technical, economic, and social factors. Data obtained from interviews conducted with representatives of local government, state agencies, and private industry yielded applications which are distributed into three major categories: automatic vehicle monitoring (i.e., monitor in real-time the locations of police vehicles to determine the nearest vehicle to a crime scene), automatic vehicle location or dispatch (i.e., send an emergency vehicle to a LORAN-C determined location), and site registration (i.e., determine and record the location of traffic accidents or violations). GRA

N77-17025# Polhemus Navigation Sciences, Inc., Burlington, Vt.
AN EXTENDED RANGE SENSOR PACKAGE (ESP) Final Report
Aurale R. DeRuyck and Jack Kuipers Wright-Patterson AFB, Ohio AMRL Jul. 1976 49 p ref
(Contract F33615-73-C-0106; AF Proj. 5973)
(AD-A027850; AMRL-TR-73-59) Avail: NTIS HC A03/MF A01 CSCL 01/4

Details efforts to develop a long-range attitude sensor capable of detecting azimuth, elevation, roll and bearing of a sensor with respect to a radiator at ranges up to 100 feet applicable to transferring coordinates to a remote station for alignment or docking. System employs a medium-frequency nutating magnetic field to sense attitude and bearing at extended ranges through any nonmagnetic nonconducting medium. Author (GRA)

N77-17026# Army Communications Command, Fort Huachuca, Ariz.
COMMUNICATIONS EQUIPMENT PLANNING GUIDE Final Report
1 May 1976 506 p
(AD-A030145; ACC-CPP-105-4) Avail: NTIS HC A22/MF A01 CSCL 17/2

The illustrated pamphlet provides information on specific items of communications equipment to assist in planning nontactical telecommunications facilities. It covers air traffic control equipment, data equipment, microwave equipment, radio

equipment, telephone equipment, telegraph equipment, and test equipment. With reference to the individual items of equipment, topics discussed include purpose, employment, description, a technical summary, and availability data. GRA

N77-17027# Strategic Air Command, Offutt AFB, Nebr.
GIANT CHANGE FINAL REPORT, KC-135 DUAL INS TEST Final Report, Nov. 1975 - Mar. 1976
Terence G. Bajuk 15 Jul. 1976 87 p
(AD-A028788) Avail: NTIS HC A05/MF A01 CSCL 05/9

The Strategic Air Command conducted a test to determine the feasibility of reducing the size of the KC-135 crew complement while maintaining mission effectiveness. This test investigated the possibility of using a three man crew (pilot, copilot, and boom operator) with the copilot assuming the navigation duties with the aid of a dual Inertial Navigation System (INS). The exercise term assigned the test was GIANT CHANGE. GRA

N77-17028# Facility Checking Squadron (1866th) (AFCS), Richards-Gebaur AFB, Mo.
TRACALS EVALUATION REPORT. COMMUNICATIONS STATION EVALUATION REPORT, KADENA AB, JAPAN, 4 MARCH - 16 MARCH 1976 Final Report
Bruce E. Wallachy 30 Jul. 1976 102 p
(AD-A029713; Rept-76/66C-63) Avail: NTIS HC A06/MF A01 CSCL 17/2

A Traffic Control and Landing Systems (TRACALS) Communications Station Evaluation was performed at Kadena AB, Japan (1962 Comm Sq) from 4 March through 16 March 1976. The purpose of the evaluation was to define the capabilities and limitations of the air traffic control VHF/UHF communications systems. Included in this report are results and analysis of equipment checks, loop test line level diagrams for the RAPCON and control tower systems, line of sight coverage data, analysis of airborne measurements, and plots of UHF radiation patterns. In addition, there is included a discussion of transmitter and receiver frequency accuracy, test equipment, VHF isolators, RAPCON keying system, modification to AN/GRT-18 transmitters, and Rivet Switch receiver output levels. The data and diagrams in this report can be used as guides for anticipated performance of the communications system at Kadena AB until there is an addition, deletion, relocation of equipment, or change in horizon profile which would affect the system. The principles presented are valid for other locations using the same communications equipment. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N77-17029* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HINGELESS HELICOPTER ROTOR WITH IMPROVED STABILITY Patent
Robert A. Ormiston, William G. Bousman, Dewey H. Hodges, and David A. Peters, inventors (to NASA) Issued 28 Dec. 1976 11 p Filed 10 Oct. 1974 Supersedes N74-34475 (12 - 24, p 2899)
(NASA-Case-ARC-10807-1; US-Patent-3,999,886; US-Patent-Appl-SN-513612; US-Patent-Class-416-104; US-Patent-Class-416-141; US-Patent-Class-416-138) Avail: US Patent Office CSCL 01C

Improved stability was provided in a hingeless helicopter rotor by inclining the principal elastic flexural axes and coupling pitching of the rotor blade with the lead-lag bending of the blade. The primary elastic flex axes were inclined by constructing the blade of materials that display non-uniform stiffness, and the specification described various cross section distributions and the resulting inclined flex axes. Arrangements for varying the pitch of the rotor blade in a predetermined relationship with lead-lag bending of the blade, i.e., bending of the blade in a plane parallel to its plane of rotation were constructed.
Official Gazette of the U.S. Patent Office

N77-17030*# Boeing Commercial Airplane Co., Seattle, Wash.
TRANSPORT AIRPLANE FLIGHT DECK DEVELOPMENT SURVEY AND ANALYSIS: REPORT AND RECOMMENDATIONS Final Report
D. K. Graham Jan. 1977 45 p refs
(Contract NAS1-13267)
(NASA-CR-145121; D6-44314) Avail: NTIS HC A03/MF A01 CSCL 01C

Results of a survey and analysis of research and development work related to improving transport airplane flight deck equipment and aircrew performance is reported. Research and development related to flight deck advancement in general, as well as that concerned directly with terminal area operations, is described and discussed. Author

N77-17031*# Kanner (Leo) Associates, Redwood City, Calif.
INVESTIGATION OF THE STEADY-STATE BEHAVIOR OF TWO DELTA-WING HANG GLIDERS
N. Rigamonti and H. Pflugshaupt Washington NASA Feb. 1977 101 p refs Transl. into ENGLISH of "Untersuchung der Stationaeren Flugzustaende von Zwei Delta-Haengegleitern", Rept. FO-1255 eidgenoessisches Flugzeugwerk, Emmen, Switzerland, Aug. 1975 91 p
(NASA-TT-F-17394; FO-1255) Avail: NTIS HC A06/MF A01 CSCL 01C

Investigations are reported for the flight behavior of two full size hang gliders in the 7x5 low speed wind tunnel. Flight characteristics at small angles of attack and the influence of the pilot's position in the swing seat are explored. In addition to showing the aerodynamic coefficients in modes of representation designed specifically for these craft, the relative safeties of the Delta-Plane and Chandelle Competition 16 are compared. The latter proves to be more stable and tends to enter a luffing dive more readily. Author

N77-17032# Committee on Aeronautical and Space Sciences (U. S. Senate).
AIRCRAFT FUEL EFFICIENCY PROGRAM
Washington GPO 1976 28 p Rept. for Comm. on Aeronautical and Space Sci., 94th Congr., 2d Sess., 17 Feb. 1976
(S-Rept-94-633; GPO-57-010) Avail: US Capitol, Senate Document Room

A technology plan is described for developing fuel-efficient aircraft. Inputs were obtained from industry, NASA research centers, and other governmental agencies. Six major programs are defined: engine component improvement, composite primary structures, turboprops, laminar flow control, fuel conservative transport, and the fuel conservative engine. Funding requirements and benefits are discussed. A.R.H.

N77-17033*# Gorham Associates, Thousand Oaks, Calif.
STUDY OF INDUSTRY INFORMATION REQUIREMENTS FOR FLIGHT CONTROL AND NAVIGATION SYSTEMS OF STOL AIRCRAFT
John A. Gorham Nov. 1976 86 p
(Contract NAS2-8790)
(NASA-CR-137950) Avail: NTIS HC A05/MF A01 CSCL 01C

Answers to specific study questions are used to ascertain the data requirements associated with a guidance, navigation and control system for a future civil STOL airplane. Results of the study were used to recommend changes for improving the outputs of the STOLAND flight experiments program. Author

N77-17034*# AVCON Aviation Consultants, Inc., Broomfield, Colo.
OPERATIONAL REQUIREMENTS FOR FLIGHT CONTROL AND NAVIGATION SYSTEMS FOR SHORT HAUL TRANSPORT AIRCRAFT
John A. Morrison Nov. 1976 142 p refs
(Contract NAS2-9028)
(NASA-CR-137975) Avail: NTIS HC A07/MF A01 CSCL 01C

Operational procedures for use in an assumed short haul transport route were evaluated. The curved path approaches in

airline use by large jet airplanes were studied. The characteristics of these approaches were included in development of operational procedures for transitions and approaches by a jet STOL transport. These procedures were used in a simulation experiment and were satisfactory for autoflight operation. A minimum turn radius of 3,000 ft. for a 180 final turn was determined for the wind conditions tested. The accuracy of the approaches was very good. Author

N77-17035*# Boeing Co., Seattle, Wash. Military Airplane Development Organization.

FOLLOW-ON STUDIES FOR DESIGN DEFINITION OF A LIFT/CRUISE FAN TECHNOLOGY V/STOL AIRPLANE, VOLUME 1 Final Report

Jan. 1977 277 p refs
(Contract NAS2-9277)
(NASA-CR-137976; D180-20487-1-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 01C

A three engine, three fan V/STOL airplane was designed for use as a Research Technology Airplane in proof-of-concept of a candidate configuration for use as a Navy multimission airplane. Use of mechanically interconnected variable pitch fans is made to accommodate power transfer for flight control in hover and to provide flight capability in the event of a single engine failure. The airplane is a modification of a T-39A transport. Design definition is provided for high risk propulsion components and a development test program is defined. Author

N77-17036*# Boeing Aerospace Co., Seattle, Wash. Military Airplane Development Organization.

WIND TUNNEL AND GROUND STATIC TESTS OF A .094 SCALE POWERED MODEL OF A MODIFIED T-39 LIFT/CRUISE FAN V/STOL RESEARCH AIRPLANE

D. Hunt, J. Clinglan, V. Salemann, and E. Omar Jan. 1977 305 p refs
(Contract NAS2-9178)
(NASA-CR-151923; D180-20338-1) Avail: NTIS HC A14/MF A01 CSCL 01C

Ground static and wind tunnel test of a scale model modified T-39 airplane are reported. The configuration in the nose and replacement of the existing nacelles with tilting lift/cruise fans. The model was powered with three 14 cm diameter tip driven turbopowered simulators. Forces and moments were measured by an internal strain guage balance. Engine simulator thrust and mass flow were measured by calibrated pressure and temperature instrumentation mounted downstream of the fans. The low speed handling qualities and general aerodynamic characteristics of the modified T-39 were defined. Test variables include thrust level and thrust balance, forward speed, model pitch and sideslip angle at forward speeds, model pitch, roll, and ground height during static tests, lift/cruise fan tilt angle, flap and aileron deflection angle, and horizonal stabilizer angle. The effects of removing the landing gear, the lift/cruise fans, and the tail surfaces were also investigated. Author

N77-17037*# Boeing Commercial Airplane Co., Seattle, Wash. Dept. of Preliminary Design.

OBLIQUE WING TRANSONIC TRANSPORT CONFIGURATION DEVELOPMENT Final Report

Jan. 1977 162 p refs
(Contract NAS2-7031)
(NASA-CR-151928; D6-75793) Avail: NTIS HC A08/MF A01 CSCL 01C

Studies of transport aircraft designed for boom-free supersonic flight show the variable sweep oblique wing to be the most efficient configuration for flight at low supersonic speeds. Use of this concept leads to a configuration that is lighter, quieter, and more fuel efficient than symmetric aircraft designed for the same mission. Aerodynamic structural, weight, aeroelastic and flight control studies show the oblique wing concept to be technically feasible. Investigations are reported for wing planform and thickness, pivot design and weight estimation, engine cycle (bypass ratio), and climb, descent and reserve fuel. Results are incorporated into a final configuration. Performance, weight, and balance characteristics are evaluated. Flight control requirements are reviewed, and areas in which further research is needed are identified. Author

N77-17038*# Douglas Aircraft Co., Inc., Long Beach, Calif.

DEVELOPMENT OF TECHNOLOGY FOR THE FABRICATION OF RELIABLE LAMINAR FLOW CONTROL PANELS ON SUBSONIC TRANSPORTS

Oct. 1976 214 p refs
(Contract NAS1-14408)
(NASA-CR-145125; MDC-J4546) Avail: NTIS HC A10/MF A01 CSCL 01C

The feasibility of using porous composite materials (Kevlar, Doweave, and Leno Weave) as lightweight, efficient laminar flow control (LFC) surface materials is compared to the metallic 319L stainless Dynapore surfaces and electron beam drilled composite surfaces. Areas investigated include: (1) selection of the LFC-suitable surface materials, structural materials, and fabrication techniques for the LFC aircraft skins; (2) aerodynamic static air flow test results in terms of pressure drop through the LFC panel and the corresponding effective porosity; (3) structural design definition and analyses of the panels, and (4) contamination effects on static drop and effective porosity. Conclusions are presented and discussed. Author

N77-17039# Bristol Univ. (England). Dept. of Aeronautical Engineering.

CARBON FIBRE REINFORCED PLASTIC SANDWICH BEAM CONSTRUCTION IN THE MAIN WING STRUCTURE OF A MAN POWERED AIRCRAFT B.S. Thesis

H. R. Al-Agha and D. C. Velupillai May 1976 91 p refs
(BU-197) Avail: NTIS HC A05/MF A01

In this entirely theoretical report, a framework similar to the wing box of the man powered aircraft Puffin 2 is analyzed for the in-flight loading imposed upon it. Design curves for the framework members, with carbon fiber reinforced plastic and honeycomb sandwich construction, are also produced. A suggested wind box design is presented; it shows a 45% weight saving over the comparable part of Puffin 2. This produces a reduction of about 7% in the total aircraft weight. Author (ESA)

N77-17040# Boeing Commercial Airplane Co., Seattle, Wash.

DESIGN AND ANALYSIS OF WINGLETS FOR MILITARY AIRCRAFT Final Report, 16 Jun. - 25 Nov. 1975

K. K. Ishimitsu, N. VanDevender, R. O. Dodson, P. C. Brault, B. A. Byers, R. P. Johnson, R. P. Syring, M. P. Schaefer, D. R. Endorf, and C. McGinnis 3 Feb. 1976 216 p refs
(Contract F33615-75-C-3123; AF Proj. 1431)
(AD-A029345; D6-41799; AFFDL-TR-76-6) Avail: NTIS HC A10/MF A01 CSCL 01/3

A study of the design and analysis on winglets for military Aircraft has been completed. The program consisted of investigating analytically winglet concepts for application to the KC-135 and C-141 designing and building winglets for an 0.035 and 0.070 scale model KC-135, and conducting a structural feasibility investigation of the winglet installation on the KC-135. The analysis of the winglets showed a 14% reduction in induced drag for the KC-135 and a 11% reduction for the C-141. The structural design study of the KC-135A winglet installation estimated a 592 lb weight increase. An 8.4% improvement was estimated in M(L/D) sub MAX and an 8.1% improvement in range factor for the KC-135A. An 0.070 scale half span KC-135 wind tunnel model has been tested in the NASA 8 ft Transonic Tunnel. Preliminary unpublished test data have substantiated the analytical procedures used by The Boeing Company to determine the aerodynamic characteristics and performance benefits from winglets on the KC-135 aircraft. Author (GRA)

N77-17041# Naval Air Test Facility, Lakehurst, N.J.

MARK 2 NOSE-GEAR-LAUNCH SYSTEM HARDWARE EVALUATION REPORT Final Report, 13 Nov. 1971 - 31 Mar. 1976

Frederick R. Sander 5 Aug. 1976 31 p refs
(AD-A029020; NATF-EN-1139) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report presents the final hardware evaluation test findings for the Mark 2 nose-gear-launch system. The evaluation was conducted concurrently with the CVN 68 catapult evaluation tests on the TC13 Mod 1 catapult site. The report describes the deficiencies and discrepancies found in the system. Incorporation of the recommended changes to these deficient items would improve operations and maintainability. Author (GRA)

N77-17042# Naval Air Test Center, Patuxent River, Md. Rotary Wing Aircraft Test Directorate.
FLIGHT TEST DEVELOPMENT OF A HELICOPTER-TOWED SURFACE DELIVERY
J. H. Edris and G. E. Clarke Jul. 1976 21 p refs
(AD-A028637; NATC-TM-76-2-RW; NATC-RW-9R-76) Avail: NTIS HC A02/MF A01 CSCL 01/3

The requirement for the U.S. Coast Guard to rapidly deploy antipollution equipment to offshore or remote sites generated a proposal to utilize an HH-3F helicopter to tow a planing hull Fast Surface Delivery (FSD) sled. The proposal was unique in that the mass of the towed surface vessel equalled or exceeded the mass of towing helicopter. The U.S. Naval Air Test Center undertook the design and fabrication of prototype hardware and the development of towing techniques and a recommended flight envelope. The design was driven by a requirement for the towing equipment to be two man transportable, manually operable, and easily removable. Two significant features of the resulting design were the use of a Kevlar 49 towing cable and the development of a quick-release hook capable of repeated releases at rated load. Flight testing revealed two families of power required curves as functions of the FSD sled operation as a displacement or planing hull. There was also a measurable sensitivity to the center of gravity location of the FSD sled. FSD sled reactions to sea states caused divergent oscillations in tow tension which could be easily damped by pilot technique. The development and test program demonstrated the suitability of helicopters to perform as a high-speed towing vehicle for very rapid overwater delivery of payloads not otherwise air transportable or rapidly surface deliverable. Author (GRA)

N77-17043# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
INVESTIGATION OF LARGER THAN A SIZE DIMENSIONAL CONFIGURATIONS Final Report
R. J. Anderson and C. O. Reitz 10 Dec. 1975 42 p refs
(AD-A029024; NADC-75295-30) Avail: NTIS HC A03/MF A01 CSCL 01/3

An investigation to determine the practicality of establishing alternate dimensional constraints for ASW stores too large for 'A' size but not so large as to require 'B' size dimensions is presented. Considered are stores deployable from the P-3C, S-3A and LAMPS aircraft. Elongation of the 'A' size sensor is a readily implemented means of increasing volume without requiring aircraft modification. Author (GRA)

N77-17044# Kamatics Corp., Bloomfield, Conn.
PREPRODUCTION TEST PROGRAM, KAFLEX DRIVE SHAFT COUPLING FOR UH-1 HELICOPTER, PHASES 8, 9 AND 10 Final Technical Report, Jun. - Dec. 1975
C. J. Wirth 13 Feb. 1976 130 p refs
(Contract DAAJ01-75-C-1110)
(AD-A028202; KC-123175; USAAVSCOM-TR-76-36) Avail: NTIS HC A07/MF A01 CSCL 01/3

Report on the final phases of a program to evaluate a replacement for the main driveshaft coupling of the UH-1 helicopter. The candidate coupling is based on the Kaflex design principle which uses flexing metal elements instead of sliding contact members, eliminating the need for lubrication maintenance, and offering longer endurance life. The reported program phases are: Demonstration of a fail safe feature, bench endurance test, and flight testing. Author (GRA)

N77-17045# Institute for Defense Analyses, Arlington, Va. Systems Evaluation Div.
THE IMPACT OF BATTLE DAMAGE ON A-10 AVAILABILITY AND SORTIE RATE
S. E. Johnson Arlington, Va. WSEG May 1976 57 p
(Contract DAHC15-73-C-0200)
(AD-A028849; P-1205; WSEG-293) Avail: NTIS HC A04/MF A01 CSCL 01/3

This study addresses in detail the question of how seriously the availability of the A-10 would be degraded as a result of battle damage. It also treats ways of minimizing the impact of this battle damage on the A-10 sortie rate. GRA

N77-17046# Human Engineering Labs., Aberdeen Proving Ground, Md.
AN INVESTIGATION OF COCKPIT LIGHTING FOR COMPATIBILITY WITH USE OF NIGHT-VISION GOGGLES, AN/PVS-5 Final Report
Harry R. Stowell Jul. 1976 22 p refs
(AD-A029212; HEL-TM-26-76) Avail: NTIS HC A02/MF A01

Cockpit lighting in U. S. Army helicopters was investigated for compatibility with use of night-vision goggles, AN/PVS-5. Instrument-lighting systems in existing Army helicopters, e.g., eyebrow lighting, post lighting, are not suitable for use with night-vision goggles. A comparatively simple flood-lighting system can provide suitable lighting in the cockpit of existing helicopters for reading instruments with night-vision goggles. The most suitable instrument-lighting system for use with the goggles is integral instrument lighting; however, indicator lights need to be modified so they are compatible with the goggles. Methods were investigated for instantaneously refocussing the goggles inside the cockpit. Luminance levels compatible for use with night-vision goggles are stated in photometric terms.
Author (GRA)

N77-17047# Frankford Arsenal, Philadelphia, Pa.
VIBRATION MEASUREMENTS ON THE ROTOR SHAFT OF THE UH-1 HELICOPTER
Harvey I. Goldman Feb. 1976 21 p
(DA Proj. 1F2-63206-D-043)
(AD-A028924; FA-TR-76009) Avail: NTIS HC A02/MF A01 CSCL 01/3

This report describes a program of in-flight vibration measurements carried out on a platform mounted atop the rotor mast on the UH-1M helicopter. Results of a real time analysis of the data are presented which reveal that a low level of vibration exists at that site making it a good location for the future placement of fire control instrumentation. A mechanical impedance study is also presented which shows that much of the high frequency present in the acceleration-time histories is a result of resonances in the tested platform. Author (GRA)

N77-17048# Bell Helicopter Co., Fort Worth, Tex.
HELICOPTER DRIVE SYSTEM ON-CONDITION MAINTENANCE CAPABILITY UH-1/AH-1 Final Report, Jul. 1974 - Jun. 1975
G. E. Knudsen and J. R. Keating Jul. 1976 249 p refs
(Contract DAAJ02-74-C-0060; DA Proj. 1F2-62203-AH-86)
(AD-A028032; BHC-299-939-0; USAAMRDL-TR-75-52) Avail: NTIS HC A11/MF A01 CSCL 01/3

The objective of this study was to assess the capability of main transmissions, intermediate gearboxes, tail rotor gearboxes, main rotor hubs, and swashplates on the UH-1 and AH-1 to operate with no scheduled overhaul periods. Overhaul and accident records, inspection procedures, and the functional capability of the caution and warning subsystem and its condition-monitoring devices were examined, and failure mode, effects and criticality analyses were performed to determine if any part or assembly failure modes would limit on-condition maintenance capability. This report concludes that UH-1/AH-1 helicopter drive system components have a capability for replacement for overhaul on an on-condition basis and that the overhaul intervals could be extended for some components or eliminated for others. The report includes recommendations for further study. GRA

N77-17049# Army Combined Arms Combat Developments Activity, Fort Leavenworth, Kans.
ANALYSIS OF PHASE IIB OF FE 43.8 Final Report
William I. Parks, Robert A. Davidson, and Rudolph J. Pabon Feb. 1976 82 p refs
(AD-A028816; CACDA-TR-3-76) Avail: NTIS HC A05/MF A01 CSCL 01/3

The effectiveness of the Scout helicopter employed as an aerial observation platform was determined. Factors used to assess this effectiveness were Scout-to-target range, Scout tactics, target motion, and level of aerial observer training and experience. Variables recorded during the experiment and used for this analysis included observer task times, Scout exposure times, observer's artillery fire direction and adjustment errors, and threat force's ability to locate the Scout position. Results of analysis indicate those factors that had a significant effect on the measures of

effectiveness and define an optimum operating procedure for artillery fire support missions using the Scout helicopter. Under the most favorable conditions encountered in Phase IIB the aerial observer was exposed to the target an average of approximately 50 seconds in order to successfully complete detection, location, call for fire, and subsequent artillery adjustment. GRA

N77-17050# Quest Research Corp., McLean, Va.
RESEARCH ON SMART TARGET FOR AERIAL COMBAT. PART 1: GENERAL DESCRIPTION Final Report
Wright-Patterson AFB, Ohio AMRL Aug. 1976 70 p refs
(Contract F33615-74-C-4053; AF Proj. 7222)
(AD-A029171; AMRL-TR-75-82-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 05/8

The object of this research effort was to provide a responsive target for air combat simulation on the Dynamic Environment Simulator located at Aerospace Medical Research Laboratory. Accomplishment of this effort required review of alternative aerial combat maneuvering models to establish an acceptable technical approach for the Smart Target tactics model. An aircraft model was then developed, using dynamics representative of an F-4E or J aircraft from aerodynamic tables. The models were incorporated in a computer program that will be implemented by AMRL. Author (GRA)

N77-17051# Quest Research Corp., McLean, Va.
RESEARCH ON SMART TARGET FOR AERIAL COMBAT. PART 2: TECHNICAL DESCRIPTION Final Report
James Kuhns Wright-Patterson AFB, Ohio AMRL Aug. 1976 147 p refs
(Contract F33615-74-C-4053; AF Proj. 7222)
(AD-A029172; AMRL-TR-75-83-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 05/8

This document contains the technical description of the 'SMART TARGET' program which is part of an air-to-air combat simulator implemented on the Dynamic Environmental Simulator located at Aerospace Medical Research Laboratory. This document, when used in conjunction with machine listings of the software, provides the technical information which a competent programmer/analyst requires to use, correct and/or modify the software described. Part 1 of this report describes in detail the tactical model employed within this program. Author (GRA)

N77-17052# Quest Research Corp., McLean, Va.
RESEARCH ON SMART TARGET FOR AERIAL COMBAT. PART 3: INTERFACE DOCUMENTATION Final Report
James Kuhns Wright-Patterson AFB, Ohio AMRL Aug. 1976 16 p
(Contract F33615-74-C-4053; AF Proj. 7222)
(AD-A029173; AMRL-TR-75-84-Pt-3) Avail: NTIS HC A02/MF A01 CSCL 05/8

Three functions must be interfaced with the responsive target computer program for this target to operate in real time. First the program must be tied to a real clock. The integration interval employed in the program is 0.1 second, thus a 0.1-second clock rate must be provided to the system. Second, the position, velocity, and attitude information concerning the state of the opponent must be provided to the program. The information will be obtained from analog voltages ranging from -10 to 10 volts that will be read into the Pacer 100 by an analog to digital converter. Third, the position and attitude of the target must be presented to the pilot in the opponent aircraft. These variables will also be provided as analog voltages and require a digital to analog conversion step. Author (GRA)

N77-17053# Naval Ship Research and Development Center, Bethesda, Md.
OVERLAND VERTICAL PLANE MOTION PREDICTION FOR AN AIR-CUSHION SUPPORTED VEHICLE: INITIAL VERIFICATION OF INERTIAL AND DAMPING CHARACTERISTICS
David D. Moran Jun. 1976 18 p refs
(AD-A028588; SPD-615-03) Avail: NTIS HC A02/MF A01 CSCL 01/1

A three degree-of-freedom mathematical model describing the time-dependent heave, pitch and surge behavior of an air-cushion-supported vehicle is under development. The model is verified for zero-speed overland oscillation by comparison of the mathematical model results with experimental data. GRA

N77-17054# Lockheed-California Co., Burbank.
REXOR ROTORCRAFT SIMULATION. VOLUME 3: USER'S MANUAL Final Report
W. D. Anderson Jul. 1976 229 p
(Contract DAAE11-66-C-3667)
(AD-A028417; LR-27463-Vol-3;
USAAMRDL-TR-76-28c-Vol-3) Avail: NTIS HC A11/MF A01 CSCL 01/3

This report describes a rotorcraft nonlinear simulation called REXOR, and is divided into three volumes. The first volume is a development of rotorcraft mechanics and aerodynamics. The second is a development and explanation of the computer code required to implement the equations of motion. The third volume is a user's manual, and contains a description of code input/output as well as operating instructions. The REXOR math model has been written for a single four-bladed, gyro-controlled, hingeless-rotor helicopter with additional capability for analysis of teeter or hinge-offset rotor systems with conventional controls and two or four blades. The helicopter modeled may be conventional in design, winged or compounded. Modeling emphasis is on an accurate main rotor description with additional degrees of freedom to describe the rest of the helicopter. REXOR has been implemented on IBM 360 and CDC 6000 series equipment. The operating instructions are primarily based on the 360 equipment usage with additional instructions to show use on the 6000 series equipment. Author (GRA)

N77-17055# Kaman Aerospace Corp., Bloomfield, Conn.
ELASTIC PITCH BEAM TAIL ROTOR FOR LOH Final Report
John D. Porterfild and Frank B. Clark Jul. 1976 91 p refs
(DA Proj. 1F1-63204-DB-38)
(AD-A028415; R-1332; USAAMRDL-TR-75-41) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report uses the results of Contract DAAJ01-73-C-0282 (P3L), Elastic Pitch Beam Tail Rotor Study for LOH Class Helicopters, and Contract DAAJ01-72-C-0006, Elastic Pitch Beam Tail Rotor, for selecting the most promising concepts to establish detailed designs that are applicable to LOH class helicopters. The designs studied herein included removable/replaceable blade airfoil shells, damage/erosion-resistant leading edge, and damage tolerant/repairable trailing edge. The elimination of bearings was an important design objective; where bearings were required, consideration was given to the use of elastomeric bearings. Improvements in reliability and maintainability, repairability, cost, performance and producibility along with interchangeability with existing tail rotor systems were also prime considerations in the design selection. Author (GRA)

N77-17056# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
DESIGN AND TESTING OF THE H-53, 450-GALLON AUXILIARY FUEL TANK CONTAINER
Ricahrd T. Gibbons Jun. 1976 18 p
(AFPEA Proj. 75-P7-37)
(AD-A028283; DSPD-76-10) Avail: NTIS HC A02/MF A01 CSCL 01/3

HQ TAC/LGT has proposed, through WR-ALC/DSP, a container design project to the Air Force Packaging Evaluation Agency (AFPEA) relative to development of a transport device/container for auxiliary fuel tanks used with the H-53 helicopter. The container(s) are essential to rapid deployment of the H-53 in contingency response situations. Since the helicopter cannot be ferried worldwide, and still meet planning/timing considerations, the H-53 is partially disassembled and moved via the C-5 Galaxy aircraft. The helicopter, however, will not fit into the C-5 with its auxiliary fuel tanks attached; also, to be air-shippable, these tanks must be purged of jet fuel fumes in accordance with AFM 71-4. This is a process normally involving 72 hours. The AFPEA has developed a sturdy handling device/container that will allow the H-53 tanks to be safely moved when partially filled with jet fuel. This container has been subjected to strenuous vibration and mechanical handling tests, along with the fit and function tests, and as a system it is fully qualified to satisfy the

design criteria. The current cost of this container is well under $350 including labor and materials. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-17057*# Scientific Translation Service, Santa Barbara, Calif.
HEAD-UP PILOTING AIDS
G. deSury Washington NASA Jan. 1977 16 p Transl. into ENGLISH from Rev. Tech. Thomson-CSF (France), v. 6, no. 3, Sep. 1974 p 787-798
(Contract NASw-2791)
(NASA-TT-F-17389) Avail: NTIS HC A02/MF A01 CSCL 01D

The advantages of piloting based on the velocity vector were discussed. The advantages of presenting information on head-up displays were listed, and descriptions were given of the various models produced. Two types of displays were described: (1) displays serving as piloting aids in good visibility, and (2) displays serving as automatic piloting and flight path monitors, it being possible for the pilot to take over the aircraft if necessary.
Author

N77-17058*# Kanner (Leo) Associates, Redwood City, Calif.
ELECTRONIC HEAD-UP DISPLAY AT PILOT'S EYE LEVEL
M. Beranovsky Washington NASA Feb. 1977 36 p refs Transl. into ENGLISH from Zravodaj VZLU (Czechoslovakia), no. 6, 1971 p 5-17
(Contract NASw-2790)
(NASA-TT-F-17390) Avail: NTIS HC A03/MF A01 CSCL 01D

Features of head-up displays, providing indications of aircraft instrument data in a symbolic form at the pilot's eye level, are described and the advantages of this method of indication are emphasized. A basic block diagram of the display is presented with a short description of the function of the individual units involved. Attention is also given to methods for the indication of instrument data and to main indication principles. A review is given of instrument data and the symbols as used in instruments of this type. A brief explanation of individual symbols is also presented. Author

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N77-17059* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REVERSE PITCH FAN WITH DIVIDED SPLITTER Patent
Leroy H. Smith, Jr., inventor (to NASA) (GE, Cincinnati, Ohio) Issued 1 Feb. 1977 6 p Filed 21 Apr. 1975 Sponsored by NASA
(NASA-Case-LEW-12760-1; US-Patent-4,005,574; US-Patent-Appl-SN-569925; US-Patent-Class-60-226A; US-Patent-Class-60-228) Avail: US Patent Office CSCL 21E

A guide vane arrangement is described for improving gas turbine performance in the reverse thrust mode. This flow straightening method produces low losses in the fluid entering a core engine during reverse thrust operations and allows large supercharging of the core engine during forward thrust.
Official Gazette of the U.S. Patent Office

N77-17060*# General Electric Co., Cincinnati, Ohio. Dept. of Advanced Engineering and Technology Programs.
SINGLE-STAGE, LOW-NOISE, ADVANCED TECHNOLOGY FAN. VOLUME 4: FAN AERODYNAMICS. SECTION 1: RESULTS AND ANALYSIS
T. J. Sullivan, I. Silverman, and D. R. Little Feb. 1977 156 p refs
(Contract NAS3-16813)
(NASA-CR-134892; Doc-R76AEG565-Vol-4) Avail: NTIS HC A08/MF A01 CSCL 20A

Test results at design speed show fan total pressure ratio, weight flow, and adiabatic efficiency to be 2.2, 2.9, and 1.8% lower than design goal values. The hybrid acoustic inlet (which utilizes a high throat Mach number and acoustic wall treatment for noise suppression) demonstrated total pressure recoveries of 98.9% and 98.2% at takeoff and approach. Exhaust duct pressure losses differed between the hardwall duct and treated duct with splitter by about 0.6% to 2.0% in terms of fan exit average total pressure (depending on operating condition). When the measured results were used to estimate pressure losses, a cruise sfc penalty of 0.68%, due to the acoustically treated duct, was projected. Author

N77-17061*# General Electric Co., Cincinnati, Ohio. Dept. of Advanced Engineering and Technology Programs.
SINGLE STAGE, LOW NOISE, ADVANCED TECHNOLOGY FAN. VOLUME 4: FAN AERODYNAMICS. SECTION 2: OVERALL AND BLADE ELEMENT PERFORMANCE DATA TABULATIONS
T. J. Sullivan Feb. 1977 340 p refs
(Contract NAS3-16813)
(NASA-CR-134893; Doc-R76AEG566-Vol-4) Avail: NTIS HC A15/MF A01 CSCL 20A

For abstract, see N77-17060.

N77-17062*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT EFFECTS ON EXHAUST NOISE FOR TURBOJET AND TURBOFAN ENGINES: COMPARISON OF EXPERIMENTAL DATA WITH PREDICTION
James R. Stone 1976 21 p refs Presented at 92d Meeting of Acoustical Soc. of Am., San Diego, Calif., 16-19 Nov. 1976
(NASA-TM-X-73552; E-8990) Avail: NTIS HC A02/MF A01 CSCL 20A

It was demonstrated that static and in flight jet engine exhaust noise can be predicted with reasonable accuracy when the multiple source nature of the problem is taken into account. Jet mixing noise was predicted from the interim prediction method. Provisional methods of estimating internally generated noise and shock noise flight effects were used, based partly on existing prediction methods and partly on recent reported engine data.
Author

N77-17063*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREDICTION OF LAMINAR AND TURBULENT BOUNDARY LAYER FLOW SEPARATION IN V/STOL ENGINE INLETS
D. C. Chou (Iowa Univ.), R. W. Luidens, and N. O. Stockman 1977 16 p refs Presented at 15th Aerospace Sci. Conf., Los Angeles, 24-26 Jan. 1977; sponsored by AIAA
(NASA-TM-X-73575; E-9028) Avail: NTIS HC A02/MF A01 CSCL 21E

A description is presented of the development of the boundary layer on the lip and diffuser surface of a subsonic inlet at arbitrary operating conditions of mass flow rate, free stream velocity and incidence angle. Both laminar separation on the lip and turbulent separation in the diffuser are discussed. The agreement of the theoretical results with model experimental data illustrates the capability of the theory to predict separation. The effects of throat Mach number, inlet size, and surface roughness on boundary layer development and separation are illustrated. Author

N77-17064*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORE NOISE MEASUREMENTS ON A YF-102 TURBOFAN ENGINE
Meyer Reshotko, Allen Karchmer, Paul F. Penko, and Jack G. McArdle 1977 27 p refs Presented at 15th Aerospace Sci.

Meeting, Los Angeles, 24-26 Jan. 1977; sponsored by AIAA (NASA-TM-X-73587; E-9050) Avail: NTIS HC A03/MF A01 CSCL 20A

Core noise from a YF-102 high bypass ratio turbofan engine was investigated through the use of simultaneous measurements of internal fluctuating pressures and far field noise. Acoustic waveguide probes, located in the engine at the compressor exit, in the combustor, at the turbine exit, and in the core nozzle, were employed to measure internal fluctuating pressures. Spectra showed that the internal signals were free of tones, except at high frequency where machinery noise was present. Data obtained over a wide range of engine conditions suggest that below 60% of maximum fan speed the low frequency core noise contributes significantly to the far field noise. Author

N77-17065*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FLAP NOISE AND AERODYNAMIC RESULTS FOR MODEL QCSEE OVER-THE-WING CONFIGURATIONS

W. Olsen, R. Burns, and D. Groesbeck 1977 26 p refs Presented at 15th Aerospace Sci. Meeting, Los Angeles, 24-26 Jan. 1977; sponsored by AIAA

(NASA-TM-X-73588; E-9051) Avail: NTIS HC A03/MF A01 CSCL 21E

Noise spectra in three dimensions and aerodynamic data were measured for a model of the NASA quiet clean short-haul experimental engine (QCSEE) over-the-wing configuration. The effects of flap length, nozzle exhaust velocity, and nozzle geometry were determined using a single nozzle and wing-flap segment. The scaled-up model data is representative of full scale flap noise with the QCSEE engine. Author

N77-17066*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPOSITE HUBS FOR LOW COST GAS TURBINE ENGINES

C. C. Chamis 1977 14 p refs Presented at the 32d Annual Conf. of the Reinforced Plastics of Composites Inst., Washington, D. C., 8-11 Feb. 1977; sponsored by the Soc. of the Plastics Ind.

(NASA-TM-X-73578; E-9038) Avail: NTIS HC A02/MF A01 CSCL 21E

A detailed stress analysis was performed using NASTRAN to demonstrate theoretically the adequacy of composite hubs for low cost turbine engine applications. Composite hubs are adequate for this application from the steady state stress view point. Author

N77-17067*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF FLAME STABILIZER DESIGN ON PERFORMANCE AND EXHAUST POLLUTANTS OF A TWO-ROW SWIRL-CAN COMBUSTOR OPERATED TO NEAR-STOICHIOMETRIC CONDITIONS

James A. Bigalow and Arthur M. Trout Feb. 1977 20 p refs (NASA-TM-X-3495; E-8317) Avail: NTIS HC A02/MF A01 CSCL 21E

Emissions and performance characteristics were determined for two full annulus modular combustors operated to near stoichiometric fuel air ratios. The tests were conducted to obtain stoichiometric data at inlet air temperatures from 756 to 894 K and to determine the effects of a flat plate circular flame stabilizer with upstream fuel injection and a contraswirl flame stabilizer with downstream fuel injection. Levels of unburned hydrocarbons were below 0.50 gram per kilogram of fuel for both combustors and thus there was no detectable difference in the two methods of fuel injection. The contraswirl flame stabilizer did not produce the level of mixing obtained with a flat plate circular flame stabilizer. It did produce higher levels of oxides of nitrogen, which peaked at a fuel air ratio of 0.037. For the flat plate circular flame stabilizer, oxides of nitrogen emission levels were still increasing with fuel air ratio to the maximum tested value of 0.045. Author

N77-17068*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE EFFECT OF FORWARD SPEED ON J85 ENGINE NOISE FROM SUPPRESSOR NOZZLES AS MEASURED IN THE NASA-AMES 40- BY 80-FOOT WIND TUNNEL

Adolph Atencio, Jr. Washington Feb. 1977 67 p refs (NASA-TN-D-8426; A-6592) Avail: NTIS HC A04/MF A01 CSCL 20A

An investigation to determine the effect of forward speed on the exhaust noise from a conical ejector nozzle and three suppressor nozzles mounted behind a J85 engine was performed in a 40- by 80-foot wind tunnel. The nozzles were tested at three engine power settings and at wind tunnel forward speeds up to 91 m/sec (300 ft/sec). In addition, outdoor static tests were conducted to determine (1) the differences between near field and far field measurements, (2) the effect of an airframe on the far field directivity of each nozzle, and (3) the relative suppression of each nozzle with respect to the baseline conical ejector nozzle. It was found that corrections to near field data are necessary to extrapolate to far field data and that the presence of the airframe changed the far field directivity as measured statically. The results show that the effect of forward speed was to reduce the noise from each nozzle more in the area of peak noise, but the change in forward quadrant noise was small or negligible. A comparison of wind tunnel data with available flight test data shows good agreement. Author

N77-17069*# California Univ., Berkeley.

POLLUTANT FORMATION IN FUEL LEAN RECIRCULATING FLOWS Ph.D. Thesis. Final Report

Robert W. Schefer and Robert F. Sawyer Washington NASA Dec. 1976 232 p refs

(Grant NsG-3028)

(NASA-CR-2785; UCB-ME-76-5) Avail: NTIS HC A11/MF A01 CSCL 21E

An opposed reacting jet combustor (ORJ) was tested at a pressure of 1 atmosphere. A premixed propane/air stream was stabilized by a counterflowing jet of the same reactants. The resulting intensely mixed zone of partially reacted combustion products produced stable combustion at equivalence ratios as low as 0.45. Measurements are presented for main stream velocities of 7.74 and 13.6 m/sec with an opposed jet velocity of 96 m/sec, inlet air temperatures from 300 to 600 K, and equivalence ratios from 0.45 to 0.625. Fuel lean premixed combustion was an effective method of achieving low NOx emissions and high combustion efficiencies simultaneously. Under conditions promoting lower flame temperature, NO2 constituted up to 100 percent of the total NOx. At higher temperatures this percentage decreased to a minimum of 50 percent. Author

N77-17070*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INTERNAL FLOW CHARACTERISTICS OF A MULTISTAGE COMPRESSOR WITH INLET PRESSURE DISTORTION

Claude E. DeBogdan, John E. Moss, Jr., and Willis M. Braithwaite Washington Feb. 1977 39 p refs

(NASA-TM-X-3446; E-8848) Avail: NTIS HC A03/MF A01 CSCL 21E

The measured distribution of compressor interstage pressures and temperatures resulting from a 180 deg inlet-total-pressure distortion for a J85-13 turbojet engine is reported. Extensive inner stage instrumentation combined with stepwise rotation of the inlet distortion gave data of high circumferential resolution. The steady-state pressures and temperatures along with the amplitude, extent, and location of the distorted areas are given. Data for 80, 90, and 100 percent of rotor design speed are compared with clean (undistorted) inlet flow conditions to show pressure and temperature behavior within the compressor. Both overall and stagewise compressor performances vary only slightly when clean and distorted inlet conditions are compared. Total and static pressure distortions increase in amplitude in the first few stages of the compressor and then attenuate fairly uniformly to zero at the discharge. Total-temperature distortion induced by the pressure distortion reached a maximum amplitude by the first two stages and decayed only a little through the rest of the compressor. Distortion amplitude tended to peak in line with the screen edges, and, except for total and static pressure in the tip zone, there was little swirl in the axial direction. Author

N77-17071*# Boeing Commercial Airplane Co., Seattle, Wash.

STATIC AND WIND TUNNEL NEAR-FIELD/FAR FIELD JET NOISE MEASUREMENTS FROM MODEL SCALE SINGLE-

FLOW BASELINE AND SUPPRESSOR NOZZLES. VOLUME 2: FORWARD SPEED EFFECTS
Carl L. Jaeck Nov. 1976 361 p refs
(Contract NAS2-8213)
(NASA-CR-137914; D6-44121-2-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 20A

A model scale flight effects test was conducted in the 40 by 80 foot wind tunnel to investigate the effect of aircraft forward speed on single flow jet noise characteristics. The models tested included a 15.24 cm baseline round convergent nozzle, a 20-lobe and annular nozzle with and without lined ejector shroud, and a 57-tube nozzle with a lined ejector shroud. Nozzle operating conditions covered jet velocities from 412 to 640 m/s at a total temperature of 844 K. Wind tunnel speeds were varied from near zero to 91.5 m/s. Measurements were analyzed to (1) determine apparent jet noise source location including effects of ambient velocity; (2) verify a technique for extrapolating near field jet noise measurements into the far field; (3) determine flight effects in the near and far field for baseline and suppressor nozzles; and (4) establish the wind tunnel as a means of accurately defining flight effects for model nozzles and full scale engines.
Author

N77-17072# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany). Unternehmensbereich Hamburger Flugzeugbau.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF NOISE SHIELDING FOR JET ENGINES Final Report
Hansjochen Boesch, Guenter Woelfer, Burckhard Kiekebusch, and Jochen Scheerer Bonn Bundesmin. fuer Forsch. u. Technol Aug. 1976 301 p refs In GERMAN; ENGLISH summary
(Contract BMFT-523-8891-LFF-29)
(BMFT-FB-W-76-09) Avail: NTIS HC A14/MF A01; ZLDI, Munich, DM 62.80

Experimental investigations of the possibilities of shielding jet engine noise through changes to aircraft configuration were carried out with a 1:10 scale aircraft half-model. Several configurations with the engines mounted above the wing were investigated in a reflection free room. A fan model with nacelle having the same scale as the aircraft model was used as a noise source. The results from these investigations were used to optimize a computer program, developed for the Europlane project, for the calculation of noise emission from noise shielded configurations. In addition to the acoustic measurements, aerodynamic interference effects were investigated for noise shielded nacelle configurations on a typical transport aircraft having a transonic wing profile. Author (ESA)

N77-17073# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Flugtreib- und Schmierstoffe.
INFLUENCE OF METALS ON THE THERMAL OXIDATION STABILITY OF AIRCRAFT TURBINE OIL ESTER BASE STOCKS
Eilhard Jantzen 24 Aug. 1976 43 p refs In GERMAN; ENGLISH summary
(DLR-FB-76-46) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, DM 21.10

Influence of metals on changes in aircraft turbine oils at elevated temperatures and in the presence of air is described. Tests were carried out with the following metals: magnesium, aluminum, titanium, iron, nickel, copper, and silver. The thermal oxidation test was conducted with test equipment developed by DFVLR. The objectives of this investigation were to determine to what degree the presence of the mentioned metals accelerate the thermal oxidation of an ester basestock. In order to determine the changes in the oil the following properties were measured and plotted against the aging temperature: viscosity, acid number, light transmittance, reaction water, gaseous and liquid cracking products. A sequence of increasing influence on the oil stability by the various metals was noted. Author (ESA)

N77-17074# Pratt and Whitney Aircraft, East Hartford, Conn.
COMPRESSOR CRITICAL RESPONSE TIME DETERMINATION STUDY Final Report, 15 Jun. 1975 - 15 Apr. 1976
R. S. Massawy, G. A. Banks, and C. R. Weber Wright-Patterson AFB, Ohio AFAL 30 Jun. 1976 57 p refs
(Contract F33615-75-C-2036; AF Proj. 5415)
(AD-A028882; PWA-5415; AFAL-TR-76-45) Avail: NTIS HC A04/MF A01 CSCL 21/5

Critical response time may be defined as the time period or duration of a compressor inlet flow distortion required for a significant effect on compressor stability. The knowledge of this time period is important as a basis for evaluating time variant inlet distortion data for its potential impact on compressor stall margin. This period can be related to the time required for fluid to travel the length of a compressor by defining a reduced frequency parameter. Critical response time can be defined for any compressor, once the critical value of reduced frequency is ascertained. Results of a mathematical model of a compressor system demonstrate that the critical value of reduced frequency is between 1.0 and 5.0. An inspection of available data indicates that a value of approximately 2.0 is the critical value. GRA

N77-17075# Pratt and Whitney Aircraft, East Hartford, Conn.
TURBINE ENGINE INFRARED SIGNATURE PROGRAM Final Report, 3 Jul. 1972 - 31 Oct. 1975
Irwin Segalman and H. Semerjian Jun. 1976 230 p refs
(Contract F33615-72-C-1840; AF Proj. 668A)
(AD-A028659; PWA-5351; AFAPL-TR-76-38) Avail: NTIS HC A11/MF A01 CSCL 21/5

This report describes the results of a forty-month program carried out as part of Air Force Contract F33615-72-C-1840 to formulate and validate a computer model to provide a realistic simulation of engine infrared radiation in an aircraft environment. The aerodynamic model provides an accurate definition of plume flowfield properties by employing solutions which define the shock systems inclusive of the Mach disc and the viscous interaction between different engine gas streams and the external flow. Using the flowfield properties as defined by the aerodynamic model, the plume infrared emissions are evaluated by a plume model which employs a long characteristics approach and a modified Curtis-Godson scaling approximation. The internal flow model provides an accurate definition of the exhaust system internal flowfield properties and wall temperatures. Using these properties, the infrared emissions due to the hot parts of the exhaust system are calculated using a hot parts computer model which accounts for direct emissions and inter-reflections, variation in surface properties, and absorption by intervening gas streams. The total system is coupled with an atmospheric attenuation model to form the Turbine Engine Infrared Radiation Signature (TEIRS) model. GRA

N77-17076# Detroit Diesel Allison, Indianapolis, Ind. Diesel Allison Div.
DEVELOPMENT OF A RETRACTABLE VANE STARTING PUMP INTEGRATED WITHIN A VAPOR CORE FUEL PUMP. TURBINE ENGINE TECHNOLOGY DEMONSTRATOR COMPONENT DEVELOPMENT PROGRAM, PROJECT 668A. CONTROLS DEVELOPMENT PROGRAM (PART 5) Final Technical Report, Jul. 1973 - Jul. 1975
N. L. Downing, K. H. Pech, and G. W. Jahrstorfer Wright-Patterson AFB, Ohio AFAPL Jul. 1975 295 p
(Contract F33657-73-C-0618; AF Proj. 668A)
(AD-A029032; DDA-EDR-8555-Pt-5; AFAPL-TR-75-85) Avail: NTIS HC A13/MF A01 CSCL 21/5

This report documents a conceptual development program, the bulk of which was performed by Chandler-Evans Controls Systems Division of Colt Industries as sub-contractor to the Detroit Diesel Allison, Div. of GMC. This Air Force funded program demonstrates the feasibility of integrating a starting fuel pump with an existing centrifugal pump to serve as a main engine fuel pump for a joint technology demonstrator turbofan engine. A retracting vane concept was designed to provide starting fuel flow up to a speed where the vanes retract and the vapor core pump takes over. An inlet throttle valve controls pump output to meet engine demand. The combined pump was fabricated and tested at all speeds up to and including max speed of 28,000 rpm and met light off, transition and max flow and pressure requirements. Weight and cost estimates are 50% of present-state-of-the art pumps. This report contains detailed design information and preliminary test results that dictated redesign and the final successful test results. In addition to favorable cost and weight estimates, appreciable reduction of fuel heating is demonstrated due to its inlet throttled non-bypassing operating mode. Author (GRA)

N77-17077# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
TRANSIENT SIMULATION OF A TWO-STAGE FAN WITH LARGE INTER-STAGE VOLUMES Interim Report, Jul. 1975 - May 1976
Stephen J. Przybylko Jul. 1976 92 p refs
(AF Proj. 3066)
(AD-A029340; AFAPL-TR-76-51) Avail: NTIS HC A05/MF A01 CSCL 21/5

This report describes a computer simulation of a two stage fan with larger than normal volumes between the two stages. The program uses the Newton-Raphson iteration method to solve the simultaneous iteration loops. The fan is modeled in a stage by stage manner. The large volumes are shown to affect the dynamic behavior of the fan. Author (GRA)

N77-17078# Purdue Univ., Lafayette, Ind. Combustion Lab.
CHARACTERISTIC TIME CORRELATION OF EMISSIONS FROM CONVENTIONAL AIRCRAFT TYPE FLAMES Final Report
J. H. Tuttle, M. B. Colket, and A. M. Mellor May 1976 144 p refs
(Grant EPA-R-802650-02)
(PB-258269/0; PURDU-CL-76-05) Avail: NTIS HC A07/MF A01 CSCL 21B

The overall combustion process occurring within a liquid spray fueled burner was analyzed in terms of the ongoing dominant subprocesses, with particular emphasis on those subprocesses deemed most critical to pollutant emissions. Liquid fuel evaporation, turbulent mixing, and chemical reaction were each considered separately and were characterized by time scales which typify the importance of each subprocess. An axisymmetric burner consisting of a flame stabilized in the wake of a disc with a liquid fuel spray injected into the wake region from the center of the disc was considered experimentally. GRA

N77-17079# Bolt, Beranek, and Newman, Inc., Arlington, Va.
SOUND EXPOSURE LEVEL VERSUS DISTANCE CURVES FOR CIVIL AIRCRAFT
Dwight E. Bishop, John F. Mills, and Jane M. Beckmann Feb. 1976 45 p refs
(Contract EPA-68-01-2265)
(PB-257798/9; BBN-2759-R) Avail: NTIS HC A03/MF A01 CSCL 13B

Sound exposure level (SEL) data for civil aircraft in a form useful for day/night average level (Ldn) calculations were provided. The SEL data were presented in tabular form; the data sources and technical analyses used in developing the noise data were summarized. GRA

N77-17080# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
EFFECTIVE PERCEIVED NOISE LEVEL VERSUS DISTANCE CURVES FOR CIVIL AIRCRAFT
Dwight E. Bishop, John F. Mills, and Jane N. Backmann Feb. 1976 73 p refs
(Contract EPA-68-01-2265)
(PB-257761/7; BBN-2747-R) Avail: NTIS HC A04/MF A01 CSCL 13B

Effective perceived noise level (EPNL) data for civil aircraft in a form useful for noise exposure forecast (NEF) calculations were provided. The EPNL noise data were presented in graphical and tabular form; the data sources and technical analyses used in developing the noise data were summarized. Noise data were included for all major current U.S. civil transport and business jet aircraft and for most general aviation aircraft. Data were also provided for possible retrofit of low bypass ratio (LBPR) turbofan transport aircraft with acoustically lined nacelles. GRA

N77-17081*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRCRAFT PISTON ENGINE EXHAUST EMISSION SYMPOSIUM
Sep. 1976 373 p Symp. held in Cleveland, 14-15 Sep. 1976 (NASA-CP-2005; E-9010) Avail: NTIS HC A16/MF A01 CSCL 21E

A 2-day symposium on the reduction of exhaust emissions from aircraft piston engines was held on September 14 and 15, 1976, at the Lewis Research Center in Cleveland, Ohio. Papers were presented by both government organizations and the general aviation industry on the status of government contracts, emission measurement problems, data reduction procedures, flight testing, and emission reduction techniques. For individual titles, see N77-17082 through N77-17100.

N77-17082*# Environmental Protection Agency, Washington, D.C.
DEVELOPMENT OF EPA AIRCRAFT PISTON ENGINE EMISSION STANDARDS
William Houtman *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 1-22 refs (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

Piston engine light aircraft are significant sources of carbon monoxide in the vicinity of high activity general aviation airports. Substantial reductions in carbon monoxide were achieved by fuel mixture leaning using improved fuel management systems. The air quality impact of the hydrocarbon and oxides of nitrogen emissions from piston engine light aircraft were insufficient to justify the design constraints being confronted in present control system developments. Author

N77-17083*# Environmental Protection Agency, Washington, D.C. Office of Mobile Source Air Pollution Control.
APPLICATION OF AUTOMOBILE EMISSION CONTROL TECHNOLOGY TO LIGHT PISTON AIRCRAFT ENGINES
David Tripp and George Kittredge *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 23-44 refs (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The possibility was evaluated for achieving the EPA Standards for HC and CO emissions through the use of air-fuel ratio enleanment at selected power modes combined with improved air-fuel mixture preparation, and in some cases improved cooling. Air injection was also an effective approach for the reduction of HC and CO, particularly when combined with exhaust heat conservation techniques such as exhaust port liners. Author

N77-17084*# Federal Aviation Administration, Washington, D.C. Dept. of Transportation.
MEASUREMENT AND TESTING PROBLEMS EXPERIENCED DURING FAA'S EMISSIONS TESTING OF GENERAL AVIATION PISTON ENGINES
Robert F. Salmon and Steven Imbrogno *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 45-72 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The importance of measuring accurate air and fuel flows as well as the importance of obtaining accurate exhaust pollutant measurements were emphasized. Some of the problems and the corrective actions taken to incorporate fixes and/or modifications were identified. Author

N77-17085*# Michigan Univ., Ann Arbor.
DATA REDUCTION AND EVALUATION PROCEDURES
William Mirsky *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 73-84 refs (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The computational procedures that are involved in exhaust emissions data reduction and the use of these computational procedures for determining the quality of the data that is obtained from exhaust measurements were considered. Four problem areas were calculated: (1) the various methods for performing the carbon balance, (2) the method for calculating water correction factors, (3) the method for calculating the exhaust molecular weight, and (4) assessing the quality of the data. S.M.

N77-17086*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY REPORT ON EFFECTS AT TEMPERATURE, HUMIDITY, AND FUEL-AIR RATIO ON TWO AIR-COOLED LIGHT AIRCRAFT ENGINES
Erwin E. Kempke, Jr. *In its* Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 85-120 refs (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

Five different engine models were tested to experimentally characterize emissions and to determine the effects of variation in fuel-air ratio and spark timing on emissions levels and other operating characteristics such as cooling, misfiring, roughness, power acceleration, etc. The results are given of two NASA reports covering the Avco Lycoming O-320-D engine testing and the recently obtained results on the Teledyne Continental TSIO-360-C engine. Author

N77-17087*# Federal Aviation Administration, Washington, D.C.
EMISSIONS DATA BY CATEGORY OF ENGINES
Joan Barriage, William Westfield, and Eric E. Becker *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 121-140 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

Exhaust gas pollutant emissions data under test stand conditions were obtained for the following: (1) full-rich baseline test (7-mode cycle), (2) lean-out tests for each power mode, and (3) different spark settings. The test data were also used to create a theoretical 5-mode cycle baseline. The emissions data in the framework of the theoretical 5-mode cycle were emphasized. There is no significant difference in the test results produced by data exhibited on the 7-mode cycle or 5-mode cycle. The 5-mode cycle was slightly more conservative for the carbon monoxide pollutant than the 7-mode cycle. The data were evaluated to determine which mode(s) had the greatest influence on improving general aviation piston engine emissions. Improvements that were achieved as a result of making lean-out adjustments to the fuel metering device were: (1) taxi mode only, (2) taxi and approach modes combined, and (3) leaning-out of the climb mode to best power. Author

N77-17088*# Avco Lycoming Div., Williamsport, Pa.
AVCO LYCOMING EMISSION AND FLIGHT TEST RESULTS
Larry C. Duke *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 141-178 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The Avco Lycoming flight test program for reduced emissions was conducted to determine and document the lean fuel schedule limits for current production aircraft based on flight safety. Based on analysis of the emissions profile, Avco Lycoming proposed to evaluate the effect of leaner schedules in the idle/taxi, climb, and approach modes. These modes were selected as areas where it was felt that possible improvements could be made with the greatest improvement in cyclic emissions reduction. The fuel systems to produce these leaner stepped fuel schedules were tailored specifically for the flight test. Author

N77-17089*# Teledyne Continental Motors, Mobile, Ala.
TELEDYNE CONTINENTAL MOTORS EMISSIONS DATA AND ANALYSIS AND FLIGHT TEST RESULTS
Bernard Rezy *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 179-208 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

Five different engine models were tested covering combinations of all engine categories in current production in the range from 100 to 435 brake horsepower. Engines were divided into five major types: carbureted, fuel injected, direct drive, geared, and turbocharged. Emissions data were categorized by three separate fuel system schedules: baseline, case 1, and case 2. Baseline was defined as the average fuel flow rate established by the fuel system's production tolerance band when operated with the mixture control at the full-rich position. Case 1 was defined as the minimum allowable fuel flow rate established by the engine certification. Case 2 was defined as the fuel rate corresponding to the leanest fuel-air ratio obtainable before a safety limit occurred with the engine operating on a propeller test stand. Safety limits that developed during testing were cylinder-head overheating or inadequate acceleration from a given mode of operation. Author

N77-17090*# Cessna Aircraft Co., Wichita, Kans.
FLIGHT TEST SUMMARY OF MODIFIED FUEL SYSTEMS
Bruce G. Barrett *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 209-224 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

Two different aircraft designs, each with two modified fuel control systems, were evaluated. Each aircraft was evaluated in a given series of defined ground and flight conditions while quantitative and qualitative observations were made. During this program, some ten flights were completed, and a total of about 13 hours of engine run time was accumulated by the two airplanes. The results of these evaluations with emphasis on the operational and safety aspects were analyzed. Ground tests of the engine alone were not able to predict acceptable limiting lean mixture settings for the flight envelopes of the Cessna Models 150 and T337. Author

N77-17091*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTRODUCTION TO NASA CONTRACTS
Erwin E. Kempke, Jr. *In its* Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 225-226 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The NASA Lewis Research Center issued requests for proposal to Avco Lycoming and Teledyne Continental Motors for a contractual effort to establish and demonstrate engine modifications to reduce exhaust emissions safely with minimum adverse effects on cost, weight, and fuel economy. The secondary objective was reducing fuel consumption. Author

N77-17092*# Teledyne Continental Motors, Mobile, Ala.
TCM AIRCRAFT PISTON ENGINE EMISSION REDUCTION PROGRAM
Bernard Rezy *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 227-254 (For primary document see N77-17081 08-07)
(Contract NAS3-19755)
Avail: NTIS HC A16/MF A01 CSCL 21E

The technology necessary to safely reduce general aviation piston engine exhaust emissions to meet the EPA 1980 Emission Standards with minimum adverse effects on cost, weight, fuel economy, and performance was demonstrated. A screening and assessment of promising emission reduction concepts was provided, and the preliminary design and development of those concepts was established. A system analysis study and a decision making procedure were used by TCM to evaluate, trade off, and rank the candidate concepts from a list of 14 alternatives. Cost, emissions, and 13 other design criteria considerations were defined and traded off against each candidate concept to establish its merit and emission reduction usefulness. A computer program was used to aid the evaluators in making the final choice of three concepts. Author

N77-17093*# Avco Lycoming Div., Williamsport, Pa.
AVCO LYCOMING/NASA CONTRACT STATUS
Larry C. Duke *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 255-274 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The standards promulgated by the Environmental Protection Agency (EPA) for carbon monoxide (CO), unburned hydrocarbon (HC), and oxides-of-nitrogen (NOx) emissions were the basis in a study of ways to reduce emissions from aircraft piston engines. A variable valve timing system, ultrasonic fuel atomization, and ignition system changes were postulated. Author

N77-17094*# Teledyne Continental Motors, Mobile, Ala.
FUTURE DEVELOPMENT PROGRAMS
Les Waters *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 275-282 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

A company program was planned which has a main drive to develop those emission reduction concepts that have the promise of earliest success. These programs were proposed in an attempt to enhance existing engine systems, exploiting their potential for emission reduction as far as is compatible with retaining the well established features in them that are well understood and in current production. The intended programs

identified in the area of new concepts were: (1) upgrading the TCM fuel system, (2) evaluation of accelerator pump, (3) reduced cooling requirement, and (4) variable spark timing. Author

N77-17095*# Avco Lycoming Div., Williamsport, Pa.
FUTURE DEVELOPMENT PROGRAMS
Stanley Jedrziewski *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 283-294 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The emission problem or source points were defined and new materials, hardware, or operational procedures were developed to exercise the trends defined by the data collected. The programs to reduce the emission output of aircraft powerplants were listed. Continued establishment of baseline emissions for various engine models, continued characterization of effect of production tolerances on emissions, carbureted engine development and flight tests, and cylinder cooling/fin design programs were several of the programs investigated. Author

N77-17096*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMISSIONS AND NEW TECHNOLOGY PROGRAMS FOR CONVENTIONAL SPARK-IGNITION AIRCRAFT ENGINES
William T. Wintucky *In its* Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 295-314 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

A long-range technology plan in support of general aviation engines was formulated and is being implemented at the Lewis Research Center. The overall program was described, and that part of the program that represents the in-house effort at Lewis was presented in detail. Three areas of government and industry effort involving conventional general-aviation piston engines were part of a coordinated overall plan: (1) FAA/NASA joint program, (2) NASA contract exhaust emissions pollution reduction program, and (3) NASA in-house emissions reduction and new technology program. Author

N77-17097*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALTERNATIVE GENERAL-AIRCRAFT ENGINES
William A. Tomazic *In its* Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 315-328 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The most promising alternative engine (or engines) for application to general aircraft in the post-1985 time period was defined, and the level of technology was cited to the point where confident development of a new engine can begin early in the 1980's. Low emissions, multifuel capability, and fuel economy were emphasized. Six alternative propulsion concepts were considered to be viable candidates for future general-aircraft application: the advanced spark-ignition piston, rotary combustion, two- and four-stroke diesel, Stirling, and gas turbine engines. Author

N77-17098*# Piper Aircraft Corp., Lockhaven, Pa.
SUMMARY OF THE GENERAL AVIATION MANUFACTURERS' POSITION ON AIRCRAFT PISTON ENGINE EMISSIONS
J. Lynn Helms *In* NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 329-336 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The General Aviation Manufacturers recommended that the EPA rescind the aircraft piston engine emissions regulations currently on the books. The reason was the very small emission reduction potential and the very poor benefit-cost ratio involved in this form of emission reduction. The limited resources of this industry can far better be devoted to items of much greater benefit to the citizens of this country - reducing noise, improving fuel efficiency (which will incidently reduce exhaust emissions), and improving the safety, operational, and economic aspects of aircraft, all far greater contributions to our total national transportation system. Author

N77-17099*# Avco Lycoming Div., Williamsport, Pa.
REVIEW OF MEASUREMENT AND TESTING PROBLEMS
In NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 337-356 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

Good instrumentation was required to obtain reliable and repeatable baseline data. Problems that were encountered in developing such a total system were: (1) accurate airflow measurement, (2) precise fuel flow measurement, and (3) the instrumentation used for pollutant measurement was susceptible to frequent malfunctions. Span gas quality had a significant effect on emissions test results. The Spindt method was used in the piston aircraft emissions program. The Spindt method provided a comparative computational procedure for fuel/air ratio based on measured emissions concentrations. Author

N77-17100*# Teledyne Continental Motors, Mobile, Ala.
REVIEW OF MEASUREMENT AND TESTING PROBLEMS
In NASA. Lewis Res. Center Aircraft Piston Eng. Exhaust Emissions Symp. Sep. 1976 p 357-378 (For primary document see N77-17081 08-07)
Avail: NTIS HC A16/MF A01 CSCL 21E

The exhaust emission test was designed to measure hydrocarbons, carbon monoxide, and oxides of nitrogen concentrations and determine mass emissions through calculations during a simulated aircraft landing-takeoff cycle. The calculations required to convert exhaust emission concentrations (raw emission measurements) into mass emissions were emphasized. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-17101 Rensselaer Polytechnic Inst., Troy, N.Y.
MODEL REFERENCE SINGLE STAGE DIGITAL ADAPTIVE FLIGHT CONTROLLER DEVELOPMENT Ph.D. Thesis
Gurbux Singh Alag 1976 147 p
Avail: Univ. Microfilms Order No. 76-27186

An explict adaptive controller, which makes direct use of online parameter identification, is described. This controller is composed of an online weighted least squares parameter identifier, a Kalman state filter, and a model following control law designed using single stage performance indices. The corresponding control gains are readily adjustable in accordance with parameter changes to ensure asymptotic stability if the conditions for perfect model following are satisfied, and stability in the sense of boundedness otherwise. When tested on the linearized equations of motion for a typical fighter aircraft, the controller was effective in compensating for parameter variations and capable of rapid recovery from a set of erroneous initial parameter estimates which defined a set of destabilizing gains. Dissert. Abstr.

N77-17102*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF VARIATIONS IN CONTROLS AND DISPLAYS ON HELICOPTER INSTRUMENT APPROACH CAPABILITY
Frank R. Niessen, James R. Kelly, John F. Garren, Jr., Kenneth R. Yenni, and Lee H. Person Washington Feb. 1977 43 p refs
(NASA-TN-D-8385; L-10982) Avail: NTIS HC A03/MF A01 CSCL 01C

A flight investigation was conducted with a variable stability helicopter to determine the effects of variations in controls and displays on helicopter instrument approach capabilities. The baseline instrument approach task was a decelerating approach to a hover along a 6 deg glide slope. Pilot evaluations were obtained for both the constant speed part of the task and the deceleration and hover part of the task. The attitude stability augmentation system (SAS) was strongly preferred over the rate SAS because the aircraft had a divergent pitch response. From a display variation standpoint, it was not possible to decelerate

to a hover in a consistent manner, regardless of the control system employed, with situation information only. In particular, the deceleration and hover part of the task was unacceptable without flight director command information. Author

N77-17103*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF A MODIFIED COMPLEMENTARY FILTERING TECHNIQUE FOR INCREASED AIRCRAFT CONTROL SYSTEM FREQUENCY BANDWIDTH IN HIGH VIBRATION ENVIRONMENT
John F. Garren, Jr., Frank R. Niessen, Terence S. Abbott, and Kenneth R. Yenni Jan. 1977 21 p refs
(NASA-TM-X-74004) Avail: NTIS HC A02/MF A01 CSCL 01D

A modified complementary filtering technique for estimating aircraft roll rate was developed and flown in a research helicopter to determine whether higher gains could be achieved. Use of this technique did, in fact, permit a substantial increase in system frequency bandwidth because, in comparison with first-order filtering, it reduced both noise amplification and control limit-cycle tendencies. Author

N77-17104# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugmechanik der Flaechenflugzeuge.
STABILIZATION, GUST ALLEVIATION AND VIBRATION DAMPING OF AN ELASTIC AIRCRAFT MODEL MOVING IN THE WIND TUNNEL Ph.D. Thesis - Tech. Univ., Brunswick
Gernot Hoffmann 11 Aug. 1976 110 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-359)
(DLR-FB-76-44) Avail: NTIS HC A06/MF A01; DFVLR, Cologne, DM 49 60

For an elastic aircraft model, which can move in the wind tunnel with several degrees of freedom, the development and practical test of a multivariable controller is discussed. The controller stabilizes the elevation and the pitch angle, alleviates vertical gusts and improves the damping of the first elastic mode. The control system synthesis depends on principles of optimization and simulation in the state space. Some low order linear filters are needed to meet the technical conditions. Author (ESA)

N77-17105# Rockwell International Corp., Cedar Rapids, Iowa. Collins Radio Group.
COMPASS COPE FLIGHT CONTROL SYSTEM REDUNDANCY STUDY Final Report, Sep. Dec. 1975
R. F. Tribuno, J. A. Klein, D. R. Stover, and K. G. Martin Wright-Patterson AFB, Ohio AFFDL 8 Apr. 1976 119 p refs
(Contract F33615-73-C-3051; AF Proj. 1957)
(AD-A029021; S-76-2; AFFDL-TR-76-59) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report presents the result of study conducted by Collins Radio Co. under contract to Calspan Corporation, to define and discuss flight control system reliability requirements, monitoring techniques and fault analysis. Also included are hardware and software reliability, implementation tradeoff discussions, configuration redundancy candidates and recommendations for further study. Author (GRA)

N77-17106# Analytical Sciences Corp., Reading, Mass.
HIGH ANGLE OF ATTACK OF STABILITY AND CONTROL Annual Technical Report, 1 Feb. 1975 - 31 Jan. 1976
Robert F. Stengel, John R. Broussard, James H. Taylor, and Paul W. Berry 7 Apr. 1976 296 p refs
(Contract N00014-75-C-0432; NR Proj. 215-237)
(AD-A027877; TASC-TR-612-1; ONR-CR-215-237) Avail: NTIS HC A13/MF A01 CSCL 01/4

High-performance aircraft are susceptible to degraded flying qualities during maneuvering flight for a number of reasons, including aerodynamic nonlinearities, inertial coupling, and rapidly changing flight conditions. Lateral-directional modes of motion coupled with longitudinal motions in asymmetric flight and high angle of attack can lead to instability and adverse control response. The pilot must adapt his control strategies to varying aircraft dynamics, and his work load is high; consequently, improper piloting procedures could occur, leading to inadvertent loss of control. GRA

N77-17107# Air Force Flight Test Center, Edwards AFB, Calif.
A NEW METHOD FOR TEST AND ANALYSIS OF DYNAMIC STABILITY AND CONTROL Final Report
Christopher J. Nagy May 1976 241 p refs
(AD-A029039; AFFTC-TD-75-4) Avail: NTIS HC A11/MF A01 CSCL 01/1

This report presents a new method of dynamic stability and control test and analysis which uses several computer programs to perform derivative extraction and characteristic analysis. The report covers the advantages of this method and the elements (test conditions, instrumentation, preferred maneuvers) required for success. In addition, complete user guide information is presented to allow setup and execution of these programs. Finally, a section is included on interpreting and evaluating the results. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N77-17108*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE LEWIS RESEARCH CENTER GEOMAGNETIC SUBSTORM SIMULATION FACILITY
Frank D. Berkopec, N. John Stevens, and John C. Sturman 1976 8 p refs Presented at Spacecraft Charging Technology Conf., Colorado Springs, Colo., 27-29 Oct. 1976; sponsored by the USAF and NASA
(NASA-TM-X-73602; E-8970-3) Avail: NTIS HC A02/MF A01 CSCL 14B

A simulation facility was established at the NASA-Lewis Research Center to determine the response of typical spacecraft materials to the geomagnetic substorm environment and to evaluate instrumentation that will be used to monitor spacecraft system response to this environment. Space environment conditions simulated included the thermal-vacuum conditions of space, solar simulation, geomagnetic substorm electron fluxes and energies, and the low energy plasma environment. Measurements for spacecraft material tests included sample currents, sample surface potentials, and the cumulative number of discharges. Discharge transients were measured by means of current probes and oscilloscopes and were verified by a photomultiplier. Author

N77-17109# Douglas Aircraft Co., Inc., Long Beach, Calif.
TECHNICAL REPORT ON AIRPORT CAPACITY AND DELAY STUDIES Final Report
Jun. 1976 185 p refs Prepared in cooperation with Peat, Marwick, Mitchell, and Co., San Francisco; McDonnell Douglas Automation Co., Long Beach, Calif.; and American Airlines, New York, N.Y.
(Contract DOT-FA72WA-2897)
(AD-A032166; FAA-RD-76-153; Rept-88277) Avail: NTIS HC A09/MF A01 CSCL 01/5

Documentation is presented of the technical studies leading to the preparation of an airfield capacity and delay handbook for the Federal Aviation Administration. The effort was divided into four major areas: (1) introduction, including definitions of airfield capacity and delay; (2) airfield capacity and delay models; (3) validation of capacity and delay models; and (4) handbook development, including technical studies, presentation concepts, and production. Author

N77-17110# Sandia Labs., Albuquerque, N.Mex.
TECHNIQUES FOR DETERMINING VELOCITY AND POSITION OF SMALL HYPERVELOCITY SPHERES
C. H. Konrad and R. E. Hollenbach Feb. 1976 16 p refs

(Contract AT(29-1)-789)
(SAND-75-0624) Avail: NTIS HC A02/MF A01

Several instrumentation techniques associated with the launching of small-diameter (2.5, 4, and 10 mm) single spheres at hypervelocities were presented. Workable solutions to target alignment, determining sabot velocity, and instrumentation triggering problems were discussed. Author (ERA)

N77-17111# Royal Aircraft Establishment, Farnborough (England).
A TEST FACILITY FOR THE CALIBRATION OF PRESSURE AND ACCELERATION TRANSDUCERS BY A CONTINUOUS SWEEP METHOD
J. S. Whitall Mar. 1976 33 p ref
(RAE-TR-75151; BR51813) Avail: NTIS HC A03/MF A01

Semi-automatic equipment developed for the calibration and acceleration transducer providing a continuous graphical presentation of the transducer performance is described. The equipment allows quick and accurate calibration of absolute, differential, and gage pressure transducers with range maxima between 350 Pa and 35 MPa (0.05 and 5000 lb/ sq in) and accelerometers with range maxima between 1.0 and 100 g sub n. Both types of transducer are calibrated by subjecting them and an accurate transducer to a continuous sweep of input parameter. Graphs are drawn by an X-Y recorder of either the direct output of the transducer under test or its output suitably processed to show departures from the ideal nominal linear output. Author (ESA)

N77-17112# Dornier-System G.m.b.H., Friedrichshafen (West Germany). Fachbereich Mechanik.
DEVELOPMENT OF A VERTICAL AXIS WIND TURBINE (PHASE 1) Final Report
Hermann Bankwitz, Albert Fritzsche, Juergen Schmelzle, Dieter Welte, and Chandrasekhara N. N. Swamy Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1976 128 p refs In GERMAN; ENGLISH summary
(Contract BMFT-ET-4135-A)
(BMFT-FB-T-76-55) Avail: NTIS HC A07/MF A01; ZLDI, Munich, DM 25.85

The aerodynamic, mechanical, operational, and manufacturing aspects of a vertical axis wind energy converter (Darrieus rotor) are dealt with. Design techniques and design studies are described. A prospective, based on the system's advantages (independence from wind direction, simplicity of manufacture, installation, and maintenance), is made to continue the development with the aim of a series production of this vertical-axis wind turbine in a performance range up to approximately 20 kW. For greater power ranges the disadvantages of this design become predominant (comparatively low rotating speed, large amount of material for the rotor blades). The horizontal rotor axis design with a considerably more advanced state of development has to be preferred in a power range above 20 kW for irrigation purposes and power supply. Author (ESA)

N77-17113# Pritsker and Associates, Inc., West Lafayette, Ind.
SAINT SIMULATION OF A REMOTELY PILOTED VEHICLE/ DRONE CONTROL FACILITY
David B. Worthman, Steven D. Duket, and Deborah J. Seifert Jul. 1976 7 p refs Presented at the Proc. of Human Factors Soc., Dallas, 14-16 Oct. 1975
(Contract F33615-75-C-5012; AF Proj. 7184)
(AD-A027812; AMRL-TR-75-68) Avail: NTIS HC A02/MF A01 CSCL 01/3

SAINT is a modeling and simulation technique that provides the concepts necessary to model systems that contain tasks (discrete elements), state variables (continuous elements), and interactions between them. SAINT has been designed to facilitate the modeling and analysis of complex man-machine systems. This paper describes a SAINT network model of a real-time simulation of a drone control facility (DCF) in which operators monitor and control the flight of simulated remotely piloted vehicles (RPVs) through the use of visual (CRT) displays. Author (GRA)

N77-17114# Army Training Support Center, Fort Eustis, Va.
ARMY FLIGHT SIMULATOR PROGRAMS FROM THE USER'S VIEWPOINT
Juri Toomepuu 12 May 1976 15 p Presented at Topical Rev., Training Devices and Flight Simulators, conducted by Office of the Director of Defense Res. and Eng., 10-13 May 1976
(AD-A029266) Avail: NTIS HC A01/MF A01 CSCL 01/3

The presentation covers three topics: (1) User evaluation of the quality and suitability of the Army flight simulator program; (2) cost effectiveness of flight simulators and (3) research initiatives needed to meet Army aviation training needs. GRA

N77-17115# Dunlap and Associates, Inc., La Jolla, Calif.
TRANSFER OF TRAINING EFFECTIVENESS: A7E NIGHT CARRIER LANDING TRAINER (NCLT), DEVICE 2F103 Final Report, Jun. 1974 - Feb. 1976
Clyde A. Brictson and William J. Burger Aug. 1976 99 p refs
(Contract N61339-74-C-0079)
(AD-A028836; NAVTRAEQUIPC-74-C-0079-1) Avail: NTIS HC A05/MF A01 CSCL 05/9

Two groups of Navy pilots who had no prior A7E experience were given differential training in a Night Carrier Landing Trainer (NCLT) to determine the transfer of training to actual night carrier qualification (CQ) landing. The groups were matched on flight experience, training grades and amount of training. NCLT training was found to transfer positively to night carrier landing performance. Statistically significant differences were found in objective measures of night Landing Performance Scores (LPS) and night boarding rate as well as night LSO scores. Transfer of training was more pronounced and effective for inexperienced Category 1 pilots who were direct from the training command than for experienced Category 1 pilots. Radar measures of final approach substantiated the night performance differences and indicated that NCLT trained pilots showed more precision in vertical flight control than the non-trainer pilots. Attrition rate was four percent for NCLT pilots compared to 30 percent for the no-trainer group. An extra 12 weeks training and 19 percent more flight time were required to qualify the attrites when they were recycled through CQ training. Implications for future training of carrier pilots and potential savings in training and flight time are discussed. Recommendations for other NCLT training research and changes in NCLT aircraft response dynamics and relative motion cues are also presented. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-17116*# Battelle Pacific Northwest Labs., Richland, Wash. Dept. of Materials.
FEASIBILITY OF PRODUCING CLOSED-CELL METAL FOAMS IN A ZERO-GRAVITY ENVIRONMENT FROM SPUTTER DEPOSITED INERT GAS-BEARING METALS AND ALLOYS. POST-FLIGHT TECHNICAL REPORT, SPAR FLIGHT 2 Final Report
J. W. Patten and E. N. Greenwell 20 Dec. 1976 76 p refs (Contract NAS8-31384)
(NASA-CR-150178) Avail: NTIS HC A05/MF A01 CSCL 22A

Metallography from experiment 24-10 obtained on the second space processing applications rocket (SPAR) flight is discussed. Results are considered along with results from the related experiments on the first SPAR flight. Conclusions are presented. Author

N77-17117*# Transemantics, Inc., Washington, D.C.
AN ARCHITECT IN A WORLD WHERE APPLES DO NOT FALL
Yaroslav Golovanov Washington NASA Feb. 1977 22 p Transl. into ENGLISH from Novyy Mir (USSR), Nov. 1976 p 212-226
(Contract NASw-2792)
(NASA-TT-F-17515) Avail: NTIS HC A02/MF A01 CSCL 22A

Problems facing architects in the design and construction of living quarters of future habitats in a space without gravitation are explored. The overwhelming influence of gravitation on the

construction of our houses, features of furnishings, and the living space itself, which is reduced to horizontal surfaces is discussed. The architecture of weightlessness will not know the size and shape restrictions, and the living space itself will be truly tridimensionally functional. It is the problem of the architect to organize this space, and his main difficulty may be in the capacity of liberating himself from habitual 'two-dimensional' thinking. Author

N77-17118*# Scientific Translation Service, Santa Barbara, Calif.
THE CONQUEST OF OUTER SPACE IN THE USSR 1974
R. Z. Sagdeyev and M. I. Shtern Washington NASA Jan. 1977 605 p refs Transl. into ENGLISH from "Osvoyeniye Kosmich. Prostranstva v SSSR", Moscow, Acad. of Sci. USSR, 1975 p 1-414
(Contract NASw-2791)
(NASA-TT-F-17259) Avail: NTIS HC A99/MF A01 CSCL 22A

Achievements and perspectives of soviet space research are presented. In addition to official data and press conference material, newspaper and journal articles written by leading scientists are included. Author

N77-17119# European Space Agency, Paris (France).
SPACELAB-BORNE LIDAR. REPORT ON THE PHASE A STUDY. VOLUME 2: TECHNICAL DESCRIPTION
17 May 1976 28 p 2 Vol.
(ESA-DP/PS(76)4-Vol-2) Avail: NTIS HC A03/MF A01

The engineering feasibility of a Spacelab-borne lidar has been demonstrated. A suitable instrument can be built which will provide scientific flexibility and growth potential. Within the lidar it is expected that the majority of equipment would be provided as facility items. This facility would be compatible with accommodation of a variety of laser heads and detector systems, which in turn provide flexiblity of scientific objectives.
Author (ESA)

N77-17679*# National Aeronautics and Space Administration, Washington, D.C.
NASA'S SPACE PROCESSING PROGRAM
James H. Bredt *In its* Bioprocessing in Space Jan. 1977 p 29-36 (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 22A

N77-17681*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE PROCESSING ON SKYLAB AND ASTP
R. S. Snyder *In its* Bioprocessing in Space Jan. 1977 p 53-66 refs (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 22A

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-17120# Analytical and Computational Mathematics, Zurich (Switzerland).
UNIFIED SYSTEM FOR ORBIT COMPUTATION (USOC). VOLUME 1: SOFTWARE ORGANIZATION, ORBIT GENERATION PART AND USER'S GUIDE
W. Maag and A. Mueller Jul. 1976 237 p refs
(Contract ESOC-663/74-T)
(ESA-CR(P)-852-Vol-1) Avail: NTIS HC A11/MF A01

A general description is given of the software design as well as the documentation of the orbit computation programs and some user instructions of the USOC. USOC is a unification of many existing programs that have been partially rearranged to permit a modular structure. It is supplemented by several driver programs. Since one of the main goals was to make the system readily adaptable to the requirements of the user, which will be different for each mission, only that operating system software with which the user can be expected to be familiar is used. Specifically, the modules are programmed in FORTRAN and full advantage is taken of the features of the linkage program (COMPOSER). Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N77-17121# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Dept. Vorprojekte und Studien.
SPACE SLED PHASE A, APPENDIX 1 Final Report
Sep. 1976 82 p
(Contract ESA-SC/89-HQ)
(ESA-CR(P)-802-App-1) Avail: NTIS HC A05/MF A01

The impact of two new requirements on the current space sled design was investigated and further calculations on the frame and damping system of this facility were performed. Concerning the requirements it is shown that head movement of the test subject as well as seat rotation can be achieved with small modifications of the current design. Enlargement of upper seat part and rotation either by a spiral device or by an electric torque motor are recommended. Concerning the dynamic behavior of the sled it is shown by means of a complete dynamic model of the facility including rails, frame support structure, and SL racks, that with a damping element of 20% between roller guiding and frame the vibration requirement of 0.001 g can be met. It is also shown that the rack stiffness is sufficient for the fastening of the support struts; however, use of more than the present three rail supports at each side is recommended.
Author (ESA)

N77-17122# Air Force Eastern Test Range, Patrick AFB, Fla.
THE UNITED STATES AIR FORCE EASTERN TEST RANGE INSTRUMENTATION HANDBOOK Final Report
Bruce E. Cone 1 Jul. 1976 175 p
(AD-A029237; AFETR-TR-76-04) Avail: NTIS HC A08/MF A01 CSCL 16/1

The Air Force Eastern Test Range (AFETR) extends from the eastern United States mainland through the south Atlantic Ocean area eastward into the Indian Ocean. It includes all stations, sites, ocean areas, and air space necessary to conduct missile and space vehicle test and development. This handbook describes the major instrumentation systems now operating, or being installed, on the ETR. The equipment and operation of each system is discussed briefly, and its location and accuracies given. Author (GRA)

N77-17123# Old Dominion Systems, Inc., Gaithersburg, Md.
SATELLITE-TO-SATELLITE TRACKING FOR ORBIT IMPROVEMENT AND DETERMINATION OF A 1 DEG x 1 DEG GRAVITY FIELD
F. M. Loveless, Jr. and B. C. Duncan Jun. 1976 177 p
(Contract DAAG53-75-C-0141)
(AD-A030026; ETL-0064) Avail: NTIS HC A09/MF A01 CSCL 22/3

The object of the contract was to investigate satellite-to-satellite tracking for orbit improvement and determination of a 1 degree x 1 degree gravity field using actual GEOS-C data. Studies were conducted at a low level of effort in order to familiarize personnel with the characteristics of the data and to obtain a limited check on the principal analysis. Results of simulations designed to accomplish the goals of the contract are presented. These simulations were made awaiting the launch of GEOS-C and the release of the initial tracking data. GEOS-C state vectors were determined from NSWC 'range difference' data. The vectors are for 13 revolutions observed during the period from 27 April 1975 to 3 May 1975. GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-17124# Committee on Science and Technology (U. S. House).
TRACKING AND DATA RELAY SATELLITE SYSTEM
Washington GPO 1976 36 p Hearing before Subcomm. on Space Sci. and Applications of Comm. on Sci. and Technol., 94th Congr., 2d Sess., No. 91, 21 Sep. 1976
(GPO-78-978) Avail: Subcomm. on Space Sci. and Applications

The tracking and data relay satellite system will permit NASA to phase out ship, aircraft, and many ground stations facilities in meeting the support requirements of the space shuttle era. Two proposals received for TDRSS services from potential contractors are analyzed. The total costs of the leased approach are compared with the equivalent costs of a government owned or purchased system. Procurement contract negotiations are discussed. A.R.H.

N77-17125# Sandia Labs., Albuquerque, N.Mex.
ROLL TORQUE EVALUATION (RTE) VEHICLE POSTFLIGHT TEST REPORT
J. K. Kryvoruka Mar. 1976 116 p refs
(Contract AT(29-1)-789)
(SAND-76-8001) Avail: NTIS HC A06/MF A01

The roll torque evaluation (RTE) vehicle, a reentry configuration which was flight-tested during May 1974, was analyzed. The roll-torque-producing effect of an ablating tape-wrapped carbon phenolic (TWCP) heat shield was evaluated. The boost system, a Talos-Terrier-Recruit (TATER) rocket, delivered the reentry configuration to conditions approximating the latter portion of full-scale reentry while providing nominal payload separation. Flight instrumentation, designed to evaluate the aerodynamic performance and thermal response of the vehicle, indicated that the flight environment was severe enough to produce the desired level of ablation and that significant rolling moments were obtained. ERA

N77-17126# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
PRELIMINARY DESIGN OF A COMPOSITE STRUCTURE FOR AN AIR FORCE SPACE APPLICATION Final Report, Jul. 1975 - Jan. 1976
John F. McCarthy, Jr. and Oscar Orringer May 1976 100 p refs
(Contract F33615-75-C-5265)
(AD-A029014; CSR-TR-76-1; AFFDL-TR-76-53) Avail: NTIS HC A05/MF A01 CSCL 22/2

Results of a preliminary design investigation of nineteen concepts for a communication satellite truss, based on construction with advanced fiber composite materials, are presented. Of the nineteen candidate concepts, two emerge as designs which appear to be structurally sound and capable of fabrication with state-of-the-art methods at reasonable cost. These structures are shown to be capable of meeting the very stringent thermal deformational stability requirements of the satellite, requirements which cannot be met by equivalent metallic structure. Additional benefits of reduced radar cross section, reduced signal interference, and weight savings, and structural reliability are also indicated for the composite designs. Author (GRA)

N77-17127# Aerospace Corp., El Segundo, Calif. Satellite Systems Div.
NATO PHASE 3 COMMUNICATIONS SATELLITE SYSTEMS EFFECTIVENESS PROGRAM Final Report
Douglas O. Heitkamp 27 May 1976 30 p refs
(Contract F04701-75-C-0076)
(AD-A030045; TR-0076(6892)-2; SAMSO-TR-76-175) Avail: NTIS HC A03/MF A01 CSCL 17/2

The systems effectiveness program for the NATO Phase 3 Communications Satellite Program is discussed, with emphasis on the product assurance requirements. The spacecraft is a spin-stabilized state-of-the-art geosynchronous design. The communications subsystem operates in the 7-8 gHz band. The integration into the space program of product assurance requirements (reliability; parts, materials, and processes; and quality assurance) brought problems as well as achievements, and these are detailed. The NATO 3 product assurance activities are presented in the context of the evolving U. S. Air Force plans and procedures used in U. S. space procurements. Also related in the paper is the ability of prime contractors to implement increasingly rigid standards and the difficulties they encounter; included is a discussion on the effectiveness of known techniques. The formulation of the Request for Proposal, proposal evaluation, technical criteria, and contractor and procurement agency negotiations are discussed. Techniques of implementation and the effects of the system effectiveness program during the manufacturing and test phases, as well as the lessons learned, are described. Author (GRA)

N77-17128*# Naval Research Lab., Washington, D.C.
ANALYSIS OF MICROWAVE RADIOMETRIC MEASUREMENTS FROM SKYLAB Final Report
Robert M. Lerner and James P. Hollinger Apr. 1976 97 p refs Sponsored in part by NASA
(NRL Proj. A01-48)
(NASA-CR-149659; AD-A028076; NRL-MR-3306) Avail: NTIS HC A05/MF A01 CSCL 08/10

The results from the 1.4-GHz, S-194, phased array passive radiometer located on the SKYLAB satellite are presented. The objective of the investigation is to establish the degree to which quantitative measurements of sea-surface conditions and related wind fields can be made using the S-194 radiometer. To interpret the radiometric measurements in terms of environmental parameters, the microwave intensity is calculated using theoretical models for the atmosphere and for the ocean surface; the total radiation is then convolved with the detailed antenna pattern of the S-194 to obtain the antenna temperature. This antenna temperature is then compared with the measured value, the environmental parameters adjusted, and the calculations iterated until agreement is obtained to within the measurement error. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N77-17129*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
GLOSSARY, ACRONYMS, ABBREVIATIONS: SPACE TRANSPORTATION SYSTEM AND ASSOCIATED PAYLOADS
A. M. Koller, Jr. Jan. 1977 113 p Revised
(NASA-TM-X-74337; KSC-GP-1052-Rev-6) Avail: NTIS HC A06/MF A01 CSCL 05B

A glossary of terms (and definitions) in current usage for the space transportation system and associated payloads, as well as acronyms and abbreviations, are presented. Author

N77-17130*# Chrysler Corp., New Orleans, La. Space Div
RESULTS OF INVESTIGATIONS CONDUCTED IN THE LaRC 8-FOOT TRANSONIC PRESSURE TUNNEL USING THE 0.010-SCALE 72-OTS MODEL OF THE SPACE SHUTTLE INTEGRATED VEHICLE (IA93), VOLUME 2
M. E. Nichols (Rockwell Intern., Downey, Calif.) Dec. 1976 763 p
(Contract NAS9-13247)
(NASA-CR-151038; DMS-DR-2326-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 22B

Test procedures, history, and plotted coefficient data are presented for an aero-loads investigation on the updated configuration-5 space shuttle launch vehicle at Mach numbers from 0.600 to 1.205. Six-component vehicle forces and moments, base and sting-cavity pressures, elevon hinge moments, wing-root bending and torsion moments, and normal shear force data were

obtained. Full simulation of updated vehicle protuberances and attach hardware was employed. Author

N77-17131*# Chrysler Corp., New Orleans, La. Data Management Services.
SUPERSONIC STABILITY AND CONTROL CHARACTERISTICS OF A 0.015 SCALE MODEL 69-0 OF THE SPACE SHUTTLE ORBITER WITH FOREBODY RSI MODIFICATIONS IN THE NASA/LaRC 4-FOOT UPWT (LEGS 1 AND 2) (LA71A/B)
Jan. 1977 126 p
(Contract NAS9-13247)
(NASA-CR-151044; DMS-DR-2271) Avail: NTIS HC A07/MF A01 CSCL 22B

Investigations are reported for the determination of aerodynamic effects of reducing the thickness of the reusable surface insulation located along the sides of the suttle orbiter in order to allow weight reduction in the nose region. Six-component aerodynamic force and moment data were obtained at Mach numbers from 1.5 to 4.6 over an angle of attack range from about -1 deg to 28 deg. Additional tests were made over an angle of sideslip range from -6 deg to 6 deg at selected angles of attack. Test results are presented in graph and tables. Author

N77-17132*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
SHUTTLE WAVE EXPERIMENTS Final Report
W. Calvert Oct. 1976 54 p refs
(Contract NAS5-23346)
(NASA-CR-144842) Avail: NTIS HC A04/MF A01 CSCL 20N

Wave experiments on shuttle are needed to verify dispersion relations, to study nonlinear and exotic phenomena, to support other plasma experiments, and to test engineering designs. Techniques based on coherent detection and bistatic geometry are described. New instrumentation required to provide modules for a variety of missions and to incorporate advanced signal processing and control techniques is discussed. An experiment for Z to 0 coupling is included. Author

N77-17133# Committee on Science and Technology (U. S. House).
SPACE SHUTTLE, 1977
Washington GPO Dec. 1976 673 p refs Rept. for Comm. on Sci. and Technol., 94th Congr., 2d Sess., Dec. 1976
(GPO-79-952) Avail: SOD HC $5.45 CSCL 22B

The issues associated with cost, performance, and schedule of the NASA space shuttle program, prior to the NASA Fiscal Year 1978 Authorization hearings were addressed. Author

N77-17134# Committee on Science and Technology (U. S. House).
OPERATIONAL COST ESTIMATES, SPACE SHUTTLE
Washington GPO 1977 24 p Rept. for Subcomm. on Space Sci. and Applications of Comm. on Sci. and Technol., 94th Congr., 2d Sess., Dec. 1976
(GPO-81-196) Avail: Subcomm. on Space Sci. and Applications

The rationale for NASA's estimated out of the pocket cost of $10.5 million (1971 dollars) per shuttle flight for 60 missions a year is given. Shuttle operating costs are used to develop the charge policy for various government and industrial users of the space transportation system. A comparison of various reimbursable service charges is included. A.R.H.

N77-17135*# National Aeronautics and Space Administration, Washington, D.C.
SPACE SHUTTLE PROGRAM ORBITER APPROACH AND LANDING TEST
11 Feb. 1977 59 p
(NASA-TM-X-74331) Avail: NTIS HC A04/MF A01 CSCL 22B

The orbiter approach and landing test (ALT) reports are published to provide senior NASA management with timely information on ALT program plans and accomplishments. The ALT reports will be comprised of this pre-ALT report, ALT pre-flight memoranda, and an ALT post-flight report following each flight. The purpose of this pre-ALT report is to provide an overview of the ALT program, describing the flight vehicles involved and summarizing the planned flights. Author

N77-17136*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF INVESTIGATIONS CONDUCTED IN THE LaRC 4-FOOT UNITARY PLAN WIND TUNNEL LEG NO. 1 USING THE 0.010-SCALE 72-OTS MODEL OF THE SPACE SHUTTLE INTEGRATED VEHICLE (IA94A)
M. E. Nichols (Rockwell Intern. Corp., Downey, Calif.) Dec. 1976 520 p
(Contract NAS9-13247)
(NASA-CR-151039; DMS-DR-2323) Avail: NTIS HC A22/MF A01 CSCL 22B

Aero-loads investigations were conducted on the updated configuration-5 space shuttle launch vehicle at Mach numbers 2.50, 3.50, and 4.50. Six-component vehicle forces and moments, base and sting-cavity pressures, elevon hinge moments, wing-root bending and torsion moments, and normal shear force data were obtained. Full simulation of updated vehicle protuberances and attach hardware was employed. Various elevon deflection angles were tested, with two different forward orbiter-to-external-tank attach-strut configurations. The entire vehicle model 72-OTS was supported by means of a balance mounted in the orbiter through its base and suspended from an appropriate sting for the specific tunnel. Author

N77-17137*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF INVESTIGATIONS CONDUCTED IN THE LARC 4-FOOT UNITARY PLAN WIND TUNNEL LEG NO. 2 USING THE 0.010-SCALE 72-OTS MODEL OF THE SPACE SHUTTLE INTEGRATED VEHICLE (IA94B)
M. E. Nichols (Rockwell Intern., Downey, Calif.) Dec. 1976 942 p
(Contract NAS9-13247)
(NASA-CR-151040; DMS-DR-2324) Avail: NTIS HC A99/MF A01 CSCL 22B
For abstract, see N77-17136.

N77-17138*# General Electric Co., Philadelphia, Pa. Space Div.
EVAL MISSION REQUIREMENTS, PHASE 1
7 May 1976 179 p refs
(Contract NAS7-24022)
(NASA-CR-152433; Doc-76SDS4227) Avail: NTIS HC A09/MF A01 CSCL 22A

The aspects of NASA's applications mission were enhanced by utilization of shuttle/spacelab, and payload groupings which optimize the cost of achieving the mission goals were defined. Preliminary Earth Viewing Application Laboratory (EVAL) missions, experiments, sensors, and sensor groupings were developed. The major technological EVAL themes and objectives which NASA will be addressing during the 1980 to 2,000 time period were investigated. Missions/experiments which addressed technique development, sensor development, application development, and/or operational data collection were considered as valid roles for EVAL flights. Author

N77-17139# Naval Undersea Center, San Diego, Calif.
SOLID ROCKET BOOSTER DEWATERING SYSTEM Research and Development Report, Aug. 1975 - Apr. 1976
A. J. Schlosser Jun. 1976 35 p
(AD-A028742; NUC-TP-514) Avail: NTIS HC A03/MF A01 CSCL 21/8

A dewatering system is required for the recovery of jettisoned solid rocket boosters (SRBs) used in the National Aeronautics and Space Administration (NASA) space shuttle program. The dewatering system will consist of an unmanned vehicle (Nozzle plug); a control console; and handling, deployment, storage, and support systems. After the nozzle plug (NP) has transited to the SRB, it will be flown into the SRB nozzle for initial spar mode dewatering. Locking arms are deployed to hold the NP, and compressed air from the recovery vessel is forced into the SRB for rapid, initial dewatering. When the SRB assumes the log mode, a sewer plug is inflated, sealing the nozzle, and final dewatering occurs. The SRB is then ready for towing.
Author (GRA)

N77-17678*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE AND LIFE SCIENCES
John A. Mason *In its* Bioprocessing in Space Jan. 1977 p 5-27 refs (For primary document see N77-17677 08-51) Avail: NTIS HC A10/MF A01 CSCL 22A

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-17140# Northwestern Univ., Evanston, Ill. Dept. of Astronomy.
THE DEVELOPMENT OF TECHNIQUES FOR THE EXTENSION OF THE MAGNITUDE SCALE IN SELECTED EQUATORIAL KAPTEYN AREAS WITH AN IMAGE ORTHICON SYSTEM Final Report, Jun. 1973 - Aug. 1974
Justus R. Dunlap, Edward J. Weiler, and J. Allen Hynek Wright-Patterson AFB, Ohio AFAL Apr. 1976 75 p
(Contract F33615-73-C-1309)
(AD-A030506) Avail: NTIS HC A04/MF A01 CSCL 17/8

The development of the image orthicon into a viable photometric tool is discussed along with the limitations of its effectiveness. It is shown that the image orthicon is capable of stellar photometry with probable errors in magnitude of 0.05. Using a 24-inch f/10 Cassegrain at the Corralitos Observatory in New Mexico, the image orthicon gave repeatable results over an eight magnitude range down to the 18th magnitude with three-second integration times. Reduction curves connecting image diameters with visual magnitudes were derived using standard magnitudes of Sandage and Eggen for stars in NGC 188 for calibration. This photometric technique is particularly adaptable to photometry of an entire field of objects.
Author (GRA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

No abstracts in this category.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N77-17141*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF ENVIRONMENTAL CHARGING EFFECT MONITORS FOR OPERATIONAL SATELLITES
N. John Stevens, John C. Sturman, and Frank D. Berkopec 1976 7 p refs Presented at the Spacecraft Charging Technology Conf., Colorado Springs, Colo., 27-29 Oct. 1976; sponsored by the USAF and NASA
(NASA-TM-X-73601; E-8970-5) Avail: NTIS HC A02/MF A01 CSCL 14B

An instrumentation package to monitor the effects of the environmental charging of spacecraft surfaces on the systems of operational spacecraft was developed. This package performs two functions: first, the local charged particle flux and the particle characteristic energy is monitored; and second, transients in the spacecraft electrical harness is counted as a function of amplitude, with time. It is used to determine the duration and effect of any environmental charging of the spacecraft surfaces. Thus, it will be possible to determine the relationship between the occurrence of any anomalies and the charging phenomenon. Design details and design goals of this package are presented.
Author

N77-17142*# General Electric Co., Philadelphia, Pa. Space Div.
EARTH VIEWING APPLICATIONS LABORATORY (EVAL). INSTRUMENT CATALOG
25 May 1976 29 p
(Contract NAS5-24022)
(NASA-CR-152435) Avail: NTIS HC A03/MF A01 CSCL 14B

There were 87 instruments described that are used in earth observation, with an additional 51 instruments containing references to programs and their major functions. These instruments were selected from such sources as: (1) earth observation flight program, (2) operational satellite improvement programs, (3) advanced application flight experiment program, (4) shuttle experiment definition program, and (5) earth observation aircraft program.
Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-17143* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLID PROPELLANT ROCKET MOTOR AND METHOD OF MAKING SAME Patent
Joseph G. Thibodaux, Jr. and Donald J. Lewis, inventors (to NASA) Issued 4 Jan. 1977 6 p Filed 16 Jan. 1963 Division of US Patent Appl. SN-54552, filed 7 Sep. 1960, US-Patent-3,193,883
(NASA-Case-XLA-1349; US-Patent-4,000,682; US-Patent-Appl-SN-256493; US-Patent-Class-86-1R; US-Patent-Class-86-20R; US-Patent-Class-264-3R; US-Patent-Class-102-49.3; US-Patent-Appl-SN-54552; US-Patent-3,193,883) Avail: US Patent Office CSCL 21H

A method is described for making a solid propellant rocket motor having a specific concavity formed within the fuel charge. A mandrel with an aperature wider than that of the casing is inserted within the motor casing and a solidifiable propellant cast above the mandrel. The mandrel is removed after the propellant is cured. Official Gazette of the U.S. Patent Office

N77-17144*# Vought Corp., Dallas, Tex.
SCOUT NOZZLE DATA BOOK
S. Shieds Dec. 1976 318 p refs
(Contract NAS1-12500)
(NASA-CR-145136) Avail: NTIS HC A14/MF A01 CSCL 21H

Available analyses and material property information are summarized relevant to the design of four rocket motor nozzles currently incorporated in the four solid propellant rocket stages of the NASA SCOUT launch vehicle. The nozzles discussed include those for the following motors: (1) first stage - Algol IIIA; (2) second stage - Castor IIA; (3) third stage - Antares IIA; and (4) fourth stage - Altair IIIA. Separate sections for each nozzle provide complete data packages. Information on the Antares

IIB motor which had limited usage as an alternate motor for the third stage is included. Author

N77-17145*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

SPACE SHUTTLE PLUME AND PLUME IMPINGEMENT STUDY Final Report

James A. Tevepaugh and Morris M. Penny Mar. 1977 11 p refs

(Contract NAS9-14845)

(NASA-CR-151202; LMSC-HREC-TR-D497190) Avail: NTIS HC A02/MF A01 CSCL 21H

The extent of the influence of the propulsion system exhaust plumes on the vehicle performance and control characteristics is a complex function of vehicle geometry, propulsion system geometry, engine operating conditions and vehicle flight trajectory were investigated. Analytical support of the plume technology test program was directed at the two latter problem areas: (1) definition of the full-scale exhaust plume characteristics, (2) application of appropriate similarity parameters; and (3) analysis of wind tunnel test data. Verification of the two-phase plume and plume impingement models was directed toward the definition of the full-scale exhaust plume characteristics and the separation motor impingement problem. I.M.

N77-17146*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

DEVELOPMENT OF SPUTTERED TECHNIQUES FOR THRUST CHAMBERS Final Report

J. R. Mullaly, R. J. Hecht, J. W. Broch, and P. A. Allard Nov. 1976 71 p refs

(Contract NAS3-17792)

(NASA-CR-135153; FR-8027) Avail: NTIS HC A04/MF A01 CSCL 21H

Procedures for closing out coolant passages in regeneratively cooled thrust chambers by triode sputtering, using post and hollow Cu-0.15 percent Zr cathodes are described. The effects of aluminum composite filler materials, substrate preparation, sputter cleaning, substrate bias current density and system geometry on closeout layer bond strength and structure are evaluated. High strength closeout layers were sputtered over aluminum fillers. The tensile strength and microstructure of continuously sputtered Cu-0.15 percent Zr deposits were determined. These continuous sputtered deposits were as thick as 0.75 cm. Tensile strengths were consistently twice as great as the strength of the material in wrought form. Author

N77-17147*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

FIFTEEN cm MERCURY ION THRUSTER RESEARCH, 1976 Annual Report, 1 Dec. 1975 - 1 Dec. 1976

Paul J. Wilbur Dec. 1976 81 p refs

(Grant NGR-06-002-112)

(NASA-CR-135116) Avail: NTIS HC A05/MF A01 CSCL 21C

Improvements in 15 cm diameter, SERT II, mercury ion thruster performance effected by the use of SHAG optics at 33 V discharge voltage were discussed. At a 200 eV/ion discharge power, 90 percent propellant utilization and 660 mA beam current condition a doubly-to-singly charged ion current ratio of about 4 percent was measured. Performance of the 15 cm multipole mercury thruster (optimized for length and the point of electron injection) was compared to that of divergent (SERT II) and cusped field designs and found to be comparable. The need for a magnetic baffle in the multipole thruster was identified and the preferred point of electron injection was at the upstream end of the discharge chamber. Results of preliminary tests on the effects of discharge voltage and total accelerating voltage on perveance and beam divergence characteristics of two grid ion optics were examined. Experimental data showing the effect of target temperature on sputtering rates in a mercury discharge environment were presented and a deficiency in the tests procedure was identified. Author

N77-17148# Bosch (Robert) G.m.b.H., Gerlingen (West Germany).

TECHNICAL STUDY AND PRODUCTION OF ROCKET NOZZLES MADE FROM HIGH-MELTING MATERIALS AS WELL AS NOZZLE COATINGS Final Report

Kuno Kirner Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1976 40 p In GERMAN; ENGLISH summary

(Contracts BMFT-RFT-3770; GfW-RV-11-08/7/70-Z)

(BMFT-FB-W-76-11) Avail: NTIS HC A03/MF A01; ZLDI, Munich, DM 8

Rocket nozzles made from copper or graphite used for high energy fuel tests were armored with tungsten by the plasma spray technique in order to achieve a longer lifetime. By the same technique, free standing nozzles were made of tungsten, molybdenum, and the compound materials tungsten + copper and molybdenum + copper. The brittleness and the low ductility of these materials should be considered not only in handling but also in the design of nozzle components, which could be achieved in the final stage of the investigation. Because the test temperatures were high above the melting temperatures of the materials even of the highest melting metals - only lifetimes of a few seconds could be expected. Metallographic evaluations of failed armored nozzles, as well as of sprayed free standing nozzles, showed that melting and carbide formation had occurred in many cases. Author (ESA)

N77-17149# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.

COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES, VOLUME 1 Final Report [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. DOCUMENT DE SYNTHESE]

J. J. Dordain Feb. 1976 26 p In FRENCH 11 Vol.

(Contract ESTEC-2451/75-MD)

(ONERA-RT-1/3237-Vol-1; ESA-CR(P)-854-Vol-1) Avail: NTIS HC A03/MF A01

Conclusions are drawn from a comparative study of apogee boost motors proposed by two different firms for the main mission of the Ariane launch vehicle. The first, using liquid propellant, is directly derived from the Symphonie motor, which limits costs and development risks. The second, using solid propellant, is technically advanced and is superior to the first in performance. ESA

N77-17150# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Energetique.

COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES. VOLUME 2: SUMMARY OF ABM STUDIES PROPOSAL BY MBB-SEP [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. ANNEXE 1: SYNTHESE DES ETUDES ABM PROPOSEES PAR MBB-SEP]

Pierre Duban 18 Feb. 1976 50 p In FRENCH 11 Vol.

(Contract ESTEC-2451/75-MD)

(ONERA-RT-1/3237-Vol-2; ESA-CR(P)-854-Vol-2) Avail: NTIS HC A03/MF A01

Studies were carried out on the technical characteristics of the apogee boost motors (ABM), one using solid propellant and the other using liquid propellant, for the proposed Ariane launcher. Points examined are: nominal performance, dispersion in the velocity increment, operation, reliability, industrial problems, growth potential, and development plan. A qualitative comparison between the two ABM's is proposed for each of these points. ESA

N77-17151# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Energetique.

COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES. VOLUME 3: ABM-SEP STUDY (SOLID PROPELLANT) [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. ANNEXE 2: ETUDE DE L'ABM-SEP (PROPERGOL SOLIDE)]

Pierre Larue 18 Feb. 1976 87 p refs In FRENCH 11 Vol.

(Contract ESTEC-2451/75-MD)

(ONERA-RT-1/3237-Vol-3; ESA-CR(P)-854-Vol-3) Avail: NTIS HC A05/MF A01

The solid propellant apogee boost motor proposed by SEP was theoretically investigated. Its main characteristics are a weak structural index and a good specific impulse value. Its configuration is simple and its performance is expected to be reliable. The development plan proposed could provide for a reduction in test firings without endangering the required reliability. ESA

N77-17152# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Energetique.
COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES. VOLUME 4: ABM-MBB STUDY (LIQUID PROPELLANT) [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. ANNEXE 3: ETUDE DE L'ABM-MBB (PROPERGOL LIQUIDE)]
Jean Muxart 18 Feb. 1976 47 p In FRENCH 11 Vol.
(Contract ESTEC-2451/75-MD)
(ONERA-RT-1/3237-Vol-4; ESA-CR(P)-854-Vol-4) Avail: NTIS HC A03/MF A01

The liquid propellant apogee boost motor (ABM) proposed by MBB was theoretically investigated. Use was made of the ABM utilized for the Symphonie satellite. A nominal thrust of 392 Newton was developed. The propellant couple applied will be N2O4, NMH allowing operation down to -10 C instead of -6 C as with the N2O4, AZ50 used previously. The propellant is supplied by pressurized helium. A development program is proposed. ESA

N77-17153# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.
COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES. VOLUME 5: ANNEX TO SUMMARY DOCUMENT, PERFORMANCE STUDY [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. ANNEXE 4 AU DOCUMENT DE SYNTHESE: ETUDE DES PERFORMANCES]
C. Aumasson and Nguyen VanNhan 17 Feb. 1976 78 p refs In FRENCH 11 Vol.
(Contract ESTEC-2451/75-MD)
(ONERA-RT-1/3237-Vol-5; ESA-CR(P)-854-Vol-5) Avail: NTIS HC A05/MF A01

Apogee boost motors using liquid propellants for geostationary orbit injection are compared, on the basis of payload mass, with those using solid propellants. An analysis of nominal performances is presented, taking into account earth flattening perturbations and boost staging effects. A statistical study was carried out to evaluate the consumption of corrections necessary to account for various dispersions. Results are also given for the case of injection maneuvers when the classical apogee impulse is preceded by one or several perigee impulses. ESA

N77-17154# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.
COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES. VOLUME 6: STUDY OF PROBLEMS CAUSED BY THE LIQUIDS [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. ANNEXE 5 AU DOCUMENT DE SYNTHESE: ETUDE DES PROBLEMES POSES PAR LES LIQUIDES]
J. P. Guibert and J. L. Marce (CNES) 17 Feb. 1976 102 p refs In FRENCH 11 Vol.
(Contract ESTEC-2451/75-MD)
(ONERA-RT-1/3237-Vol-6; ESA-CR(P)-854-Vol-6) Avail: NTIS HC A06/MF A01

Problems caused by the liquid propellant for the apogee boost motor are examined. The most important problem stems from a spin stabilized vehicle during the transfer phase. The quality of the nutation motion affected by a large mass of rotating liquid was studied. The risk of the opening of the propellant draining orifices under the influence of the liquid vibrating near thrust termination was also studied. ESA

N77-17155# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.
COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES. VOLUME 7: STUDY OF MECHANICAL CONFIGURATIONS AND INTERFACES [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. ANNEXE 6 AU DOCUMENT DE SYNTHESE: ETUDE DES CONFIGURATIONS ET INTERFACES MECANIQUES]
Moskwa (CNES) and Lerr (CNES) Feb. 1976 120 p In FRENCH 11 Vol.
(Contract ESTEC-2451/75-MD)
(ONERA-RT-1/3237-Vol-7; ESA-CR(P)-854-Vol-7) Avail: NTIS HC A06/MF A01

The possible configurations and dimensions of two alternative apogee boost motors (solid and liquid) were examined in order to determine whether they can be differentiated with respect to vibration behavior, dynamic stability of the satellite apogee motor system, integration complexity, or launching base procedures. ESA

N77-17156# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.
COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES. VOLUME 8: INTERFACE STABILIZATION AND STABILIZATION SERVOS [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. ANNEXE 7 AU DOCUMENT DE SYNTHESE: INTERFACE STABILISATION ET SERVITUDES STABILISATION]
Duchon (CNES) and Lerr (CNES) Feb. 1976 69 p In FRENCH 11 Vol.
(Contract ESTEC-2451/75-MD)
(ONERA-RT-1/3237-Vol-8; ESA-CR(P)-854-Vol-8) Avail: NTIS HC A04/MF A01

The effects of the type of spacecraft stabilization used on the choice of the apogee motor are considered. The two stabilization modes were compared by analyzing spin stabilization on one part and an example of three-axis stabilization for a liquid motor on the other. Results of the comparison show that, although a more detailed study is necessary for three-axis stabilization, it is feasible and allows use of liquid propellant even in the case of an unsteady vehicle. ESA

N77-17157# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.
COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES. VOLUME 9: THERMAL INTERFACES [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. ANNEXE 8 AU DOCUMENT DE SYNTHESE: INTERFACES THERMIQUES]
Mauduyt (CNES) and Lerr (CNES) Feb. 1976 19 p refs In FRENCH 11 Vol.
(Contract ESTEC-2451/75-MD)
(ONERA-RT-1/3237-Vol-9; ESA-CR(P)-854-Vol-9) Avail: NTIS HC A02/MF A01

The effects of thermal problems upon the choice of the apogee motor (liquid or solid) are studied. Results show that thermal problems are simpler in the case of a liquid propellant motor and, in either case, well identifiable and not unsurmountable. ESA

N77-17158# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.
COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES. VOLUME 10: CONTAMINATION STUDY [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. ANNEX 9 AU DOCUMENT DE SYNTHESE: ETUDE CONTAMINATION]

Guillin (CNES) and Lerr (CNES) Feb. 1976 23 p refs In FRENCH 11 Vol.
(Contract ESTEC-2451/75-MD)
(ONERA-RT-1/3237-Vol-10; ESA-CR(P)-854-Vol-10) Avail: NTIS HC A02/MF A01

The main sources of contamination of a liquid and solid apogee motor system are identified, and the potential of motor environment contamination is comparatively evaluated. Results show that the liquid motor seems to be more advantageous, though this is not necessarily a selection criterion within the limits of the study. ESA

N77-17159# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Energetique.
COMPARATIVE STUDY OF MOTORS FOR ORBITAL INJECTION OF GEOSTATIONARY SATELLITES. VOLUME 11: COMPARISON OF BILIQUID 2000 NEWTON MOTORS [ETUDE COMPARATIVE DE MOTEURS D'INJECTION POUR LA MISE A POSTE DE SATELLITES GEOSTATIONNAIRES. COMPARAISON DES MOTEURS BILIQUIDES 2000 NEWTONS]
Jean-Jacques Dordain and Jean Muxart 3 Jun. 1976 26 p refs In FRENCH 11 Vol.
(Contract ESTEC-2451/75-MD)
(ONERA-RT-2/3237-Vol-11; ESA-CR(P)-854-Vol-11) Avail: NTIS HC A03/MF A01

Conclusions of a comparative study of apogee boost motors, proposed by MBB and SEP, are presented. The motors examined are based on similar technologies (gas generation by hydrazine decomposition); their performance is excellent, which should result in a considerable improvement in the Ariane launcher performance by using a perigee impulse. ESA

N77-17160# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
CHARACTERIZATION OF SUDDEN-EXPANSION DUMP COMBUSTOR FLOWFIELDS Final Report, 1 Jul. 1975 - 30 Jun. 1976
James E. Drewry Jul. 1976 67 p refs
(AF Proj. 7065)
(AD-A029494; AFAPL-TR-76-52) Avail: NTIS HC A04/MF A01 CSCL 20/4

Basic flowfield studies pertinent to an axisymmetric, sudden-expansion dump combustor have been performed under cold flow conditions. These studies have included surface flow visualization, pressure probing, and gas sampling within a representative combustor duct. Flow visualization tests, which were performed using a surface oil flow technique, graphically demonstrated the complex nature of the flow recirculation/reattachment region downstream of the dump station. Detailed measurements of wall static pressure, flow static pressure, and flow total pressure were made for the combustor flowfield. Gas concentration measurements of simulated fuel (argon)/air mixing were made in the combustor duct using a unique on-line, real-time gas sampling/analysis system. The results obtained from this particular research effort have provided additional insight into the complexities of dump combustor flowfields. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-17161* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ANALYSIS OF VOLATILE ORGANIC COMPOUNDS Patent
Albert Zlatkis, inventor (to NASA) (Houston Univ.) Issued 18 Jan. 1977 16 p Filed 12 Mar. 1974 Supersedes N74-19776 (12 - 11, p 1259) Sponsored by NASA
(NASA-Case-MSC-14428-1; US-Patent-4,003,257; US-Patent-Appl-SN-450504; US-Patent-Class-73-23.1; US-Patent-Class-23-230R; US-Patent-Class-23-230B; US-Patent-Class-23-230M; US-Patent-Class-23-231; US-Patent-Class-23-232R; US-Patent-Class-23-232C; US-Patent-Class-23-254R; US-Patent-Class-55-67; US-Patent-Class-55-74; US-Patent-Class-55-197; US-Patent-Class-73-61.1C) Avail: US Patent Office CSCL 07C

An apparatus and method are described for reproducibly analyzing trace amounts of a large number of organic volatiles existing in a gas sample. Direct injection of the trapped volatiles into a cryogenic percolum provides a sharply defined plug. Applications of the method include: (1) analyzing the headspace gas of body fluids and comparing a profile of the organic volatiles with standard profiles for the detection and monitoring of disease; (2) analyzing the headspace gas of foods and beverages and comparing the profile with standard profiles to monitor and control flavor and aroma; and (3) analyses for determining the organic pollutants in air or water samples.
Official Gazette of the U.S. Patent Office

N77-17162# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
GUIDELINES FOR SPACE MATERIALS SELECTION
Paris ESA 1 Jul. 1976 86 p refs
(ESA-PSS-07/QRM-01-ESTEC) Avail: NTIS HC A05/MF A01

A brief review of the different classes of materials used in spacecraft manufacture is given. Their chemical nature and physical aspects are described and some consideration to their processing and assembly methods is given. Precautions to be taken and materials to be avoided are emphasized for each class. General effects of the space environment are also described. Some individual materials which are suitable for space application under certain conditions are mentioned. Author (ESA)

N77-17317# Osaka Univ. (Japan). Dept. of Petroleum Chemistry.
REACTION OF XYLENE WITH AMMONIA
Akira Uchida, Hisakazu Hayaoka, and Sumio Matsuda *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 617-622 refs (For primary document see N77-17291 08-31)
(Rept-1335) Avail: NTIS HC A10/MF A01

N77-17318# Osaka Univ. (Japan). Dept. of Petroleum Chemistry.
OXIDATION OF ALDEHYDES BY HYDROGEN PEROXIDE IN THE PRESENCE OF SELENIUM DIOXIDE CATALYST
Yasutaka Ishii (Kansai Univ.), Shinji Murai, and Noboru Sonoda *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p623-626 refs (For primary document see N77-17291 08-31)
(Rept-1336) Avail: NTIS HC A10/MF A01

24 COMPOSITE MATERIALS

Includes laminates.

N77-17163 Utah Univ., Salt Lake City.
THE CREEP OF MAGNESIA AND ALUMINA DOPED WITH TRANSITION ELEMENT IMPURITIES Ph.D. Thesis
Paul Alan Lessing 1976 193 p
Avail: Univ. Microfilms Order No. 76-30482

Polycrystalline aluminum oxide and magnesium oxide were hot-pressed to high density and creep tested using four-point bending dead load and stress relaxation techniques. The relative contributions of various diffusion and dislocation mechanisms were studied as a function of point defect concentration, which were varied by doping with various aleovalent impurities and varying the oxygen partial pressure. Both pure and iron doped magnesium oxide were tested as well as pure and titanium-manganese, iron, and chromium doped aluminum oxide. Results on MgO indicate diffusional creep mechanisms which are predominant at low stresses and small grain sizes, are not important at high stresses and large grain sizes. For pure and iron doped (0.53 cation percent) MgO the nonviscous mechanism is essentially the same. Grain size and stress dependence tests indicate that pure and chromium doped alumina exhibit Naborro-Herring diffusional creep in 7-70/micrometers grain size range.
Dissert. Abstr.

DATA SUMMARY: Data summary not prepared due to nonavailability of complete document for processing.

N77-17164*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTIC PROPERTIES AND FRACTURE STRENGTH OF QUASI-ISOTROPIC GRAPHITE/EPOXY COMPOSITES
T. L. Sullivan 1977 16 p refs Presented at Conf. on Composites and Advanced Materials, Cocoa Beach, Fla., 17-19 Jan. 1977; sponsored by Am. Ceramic Soc.
(NASA-TM-X-73592; E-9060) Avail: NTIS HC A02/MF A01 CSCL 11D

The layups of the studied laminates are (0, + or - 60) sub s, (0, + or - 45, 90) sub s, (0, + or - 30, + or - 60, 90) sub s (0, + or - 22 1/2, + or - 45, + or - 67 1/2, 90) sub s. The properties determined were tensile modulus, Poisson's ratio, bending stiffness, fracture strength and fracture strain. Measured properties and properties predicted using laminate theory were found to be in reasonable agreement. Reasons for data scatter were determined. Author

DATA SUMMARY: Measured and predicted elastic properties in tension and bending of laminates made from high modulus graphite fiber and epoxy plys; the variables include ply properties, elastic constants, tensile modulus, Poisson's ratio, axial stress, strain rate, load angle, ply alignment, fracture strength, and fracture strain; 9 figures and 2 tables include numeric data.

N77-17165*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FATIGUE DAMAGE OF NOTCHED BORON/EPOXY LAMINATES UNDER CONSTANT AMPLITUDE LOADING
G. L. Roderick and J. D. Whitcomb 20 Dec. 1976 32 p refs Presented at ASTM Symp. on Fatigue of Filamentary Composites, Denver, 15-18 Nov. 1976
(NASA-TM-X-73994) Avail: NTIS HC A03/MF A01 CSCL 11D

Fatigue damage in (0, + or - 45) and (0, + or - 45,90) boron/epoxy laminates was studied with X-ray radiography and scanning electron microscopy. In addition, limited tests for residual strength and stiffness were performed. The results of this study suggest that in boron/epoxy laminates the 45-degree plies play a key role in the fatigue process of boron/epoxy laminates that contain them. The fatigue process in the + or - 45-degree plies starts as intralaminar matrix cracks. Author

DATA SUMMARY: Fracture analyses of fatigue damage mechanisms in notched laminates having 45- and 45,9-degree plies; the variables include tension fatigue, compression fatigue, static fatigue, fiber breakage, matrix cracking, axial stiffness, residual strength, modulus of elasticity, and stacking sequences; 4 figures and one table include numeric data.

N77-17166*# Scientific Translation Service, Santa Barbara, Calif.
TECHNOLOGICAL STUDIES IN THE SYSTEM Si3N4-Al2O3
W. Wruss, R. Kieffer, E. Gugel, and B. Willer Washington NASA Feb. 1977 26 p refs Transl. into ENGLISH from Spechsaal (Coburg), v. 108, no. 13/14, 1975 p 378-384
(Contract NASw-2483)
(NASA-TT-F-17384) Avail: NTIS HC A03/MF A01 CSCL 11D

Properties (density, hardness, bending strength, thermal conductivity, thermal expansion coefficient, oxidation behavior, reactivity with nitrogen, microscopic appearance, etc.) are reported for the system Si3N4-Al2O3. Author

DATA SUMMARY: Chemical composition and physical properties of hot pressed silicon nitride/aluminum oxide solid solution ceramics are compared to hot pressed silicon nitride with 5 percent magnesium oxide; the variables include chemical composition, density (g/cu cm), hardness, molecular ratio, bending strength, thermal conductivity, thermal expansion coefficient, oxidative weight change, lattice parameters as function of composition, and phase transformation; 15 figures and 3 tables include numeric data.

N77-17167*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY EVALUATION OF FIBER COMPOSITE REINFORCEMENT OF TRUCK FRAME RAILS
James R. Faddoul 1977 22 p Presented at the Congr. and Exposition sponsored by the Soc. of Automotive Engineers, Detroit, 28 Feb. - 4 Mar. 1977
(NASA-TM-X-73582; E-9044) Avail: NTIS HC A02/MF A01 CSCL 11D

The use of graphite fiber/resin matrix composite to effectively reinforce a standard steel truck frame rail is studied. A preliminary design was made and it was determined that the reinforcement weight could be reduced by a factor of 10 when compared to a steel reinforcement. A section of a 1/3 scale reinforced rail was fabricated to demonstrate low cost manufacturing techniques. The scale rail section was then tested and increased stiffness was confirmed. No evidence of composite fatigue was found after 500,000 cycles to a fiber stress of 34,000 psi. The test specimen failed in bending in a static test at a load 50 percent greater than that predicted for a non-reinforced rail. Author

DATA SUMMARY: Static deflection, cyclic stress fatigue, and bending test were performed on 1/3 scale steel rail sections reinforced by graphite/resin caps for increased stiffness and buckling load capability; the variables include frame rail design parameters, reinforcement weight, graphite composite thickness, fiber modulus, moment of inertia, load deflection, and crack location and propagation; 6 figures and two tables include numeric data.

N77-17168# Lockheed Missiles and Space Co., Palo Alto, Calif.
FORMATION OF RESIDUAL STRESSES IN ARTICLES FROM LAYERED AND FIBER COMPOSITES DURING SOLIDIFICATION
V. V. Bolotin and A. N. Vorontsov [1976] 7 p refs Transl. into ENGLISH from Mekh. Polim. (USSR), no. 5, 1976 p 790-795
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The theory of residual stresses which originate in wound articles from composite materials was proposed. The influence of parameters of the technological process on mechanical reliability of articles was analyzed. The most dangerous residual stresses in glass-plastics were radial stresses which were developed mainly during the cooling stage. Both the maximum radial stress and the transversal rupture strength grow during cooling. A definite strength margin relative to radial stresses can be conserved in the whole cooling stage. Author

DATA SUMMARY: Plane stress state cases on residual stresses in fibrous and layered composites are presented; variables include temperature and time; 4 figures include numeric data.

N77-17169# Oak Ridge Y-12 Plant, Tenn.
DETERMINATION OF LOW-VOLATILE MATTER IN HIGH-PURITY CARBONACEOUS MATERIAL
L. D. Keele May 1976 10 p refs
(Contract W-7405-eng-26)
(Y-2044) Avail: NTIS HC A02/MF A01

High-purity carbonaceous material can be effectively analyzed for small quantities of volatile matter by heating the sample to 950 C in a quartz reaction tube under a flow of an inert gas. All of the operations of the analysis were performed at the exit end of the reaction tube. The volatile matter measured by weight loss of the sample confirmed its reproducibility in this type of analysis. Author (ERA)

DATA SUMMARY: No numeric data are presented.

N77-17170# California Univ., Berkeley. Lawrence Berkeley Lab.
SPINEL POWDER: PREPARATION BY USE OF FREEZE DRYING, CHARACTERIZATION AND CORRELATION WITH MICROSTRUCTURE Ph.D. Thesis
Chi-Shine Tao Apr. 1976 151 p refs
(Contract W-7405-eng-48)
(LBL-3978) Avail: NTIS HC A08/MF A01

Reactive $MgAl_2O_4$ powders were prepared by calcining freeze

dried aqueous solutions of MgSO4 and Al2(SO4)3 hydrates. The freeze dried powders were characterized in terms of structure, dehydration kinetics, thermal reactions, particle size distribution, and particle aggregation. The calcined powders were characterized in terms of their crystalline phases, residue sulfate content, crystallite growth during calcination, and spectragraphic analysis. Spinel powers of nearly single crystalline phase and the finest crystallite size have the fastest sintering rate. Powder packing homogeneity increases with increasing green body density for powders with the same characteristics. Excess residue sulfate results in a grain boundary second phase for short time sinterings. This second phase was removed by annealing in air at 1500 C, leaving pores along grain boundaries. Small amounts of residue sulfate form entrapped pores inside the grains during grain growth. It was found that long time vacuum calcination of the powder and secondary calcination in hydrogen remove the residue sulfate and thus reduce the entrapped pores. Author (ERA)

DATA SUMMARY: Sintering of a single phase spinel from powders of different characteristics under different fabrication conditions; variables include calcination time calcination temperature, drying time, drying temperature, sintering time, sintering temperature, crystallite size, wt % sulfur residue, and weight loss; 14 figures and 3 tables include numeric data.

N77-17171# Battelle Pacific Northwest Labs., Richland, Wash.
GAS RELEASE FROM IRRADIATED SOLIDS
L. C. Olsen Apr. 1976 51 p refs
(Contract E(45-1)-1830)
(BNWL-2002) Avail: NTIS HC A04/MF A01

Experimental and theoretical aspects of inert gas diffusion and release from solids were discussed. An overview of previous gas release studies was given. In particular, gas release from single region and composite solids was studied with and without trapping. Results obtained with a computer code developed for a composite solid with reversible trapping were discussed. Finally, approaches to calculating the initial concentration profile in samples which were irradiated with alpha particles were considered. Author (GRA)

DATA SUMMARY: Materials doped with helium were heated and gas release was monitored with a mass spectrometer; variables include time, temperature, release rate, release fraction, irradiation conditions, nature of diffusion, and helium concentration; 6 figures and 1 table include numeric data.

N77-17172# Sandia Labs., Albuquerque, N.Mex.
TITANIUM CARBONITRIDES BY CHEMICAL VAPOR DEPOSITION
H. O. Pierson 1976 15 p refs Presented at the Intern. Conf. on Metallurgical Coatings, San Francisco, 5 Apr. 1976 Sponsored by ERDA
(SAND-75-6105; Conf-760415-2) Avail: NTIS HC A02/MF A01

Hard, abrasion-resistant coatings obtained by the chemical vapor deposition of titanium carbonitrides were studied. By using amines as a source of carbon and nitrogen, uniform and adherent coatings were obtained at a deposition temperature of 550 to 650 C, provided the steel substrate was electroplated with nickel or cobalt to prevent the formation of interfacial iron chlorides. X-ray diffraction showed that the lattice parameter of the coatings increased with higher deposition temperatures with a corresponding increase in the carbide mole percent which rose from 24 percent at 550 C to 70 percent at 650 C. The lattice parameter and the carbide mole percent were also higher with trimethylamine than with dimethylamine (53 percent and 30 percent, respectively, at 600 deg C). Variations in the color of the coating were noted and related to the carbide mole percent. ERA

DATA SUMMARY: Characteristics of titanium carbonitride coatings; variables include deposition temperature, mole percent, lattice parameter; 2 tables include numeric data.

N77-17173# AeroChem Research Labs., Inc., Princeton, N. J.
TEMPERATURE DEPENDENCE OF Al/O2 AND AlO/O2 KINETICS Final Report, 1 Nov. 1974 - 1 Aug. 1975
Arhtur Fontijn, William Felder, and James J. Houghton Jul. 1976 35 p refs
(Contract F30602-75-C-0048; AF Proj. 1649; DNA Proj. NWED-QAXH-I002)
(AD-A028986; AeroChem-TR-327; RADC-TR-76-212) Avail: NTIS HC A03/MF A01

Rate coefficients for the Reactions Al+O2 yields AlO+O and AlO+O2 yields AlO2+O show agreement with previous determinations in a high-temperature fast flow reactor at 1000-1700 and at 1400K, respectively. This report presents the results of investigations at temperatures as low as 310 K. The reaction rate for Al+O2 yields AlO+O was determined to the (3 + or - 2) x 10 to the -11th power ml per molecule per second. The reaction rate for AlO+O2 yields AlO2+O was determined to be (5 + or -3) x 10 to the -11th power ml per molecule per second over the 310K - 1400K temperature range. Author (GRA)

DATA SUMMARY: Kinetics of the atomic aluminum/oxygen reaction in the 300 to 1700 K range; variables include temperature effects, pressure effects, and molecular absorption rate (time); no figures and 2 tables include numeric data.

N77-17174# Westinghouse Research Labs., Pittsburgh, Pa.
PHASE RELATIONS IN THE Si3N4-SiO2-MgO SYSTEM AND THEIR INTERRELATIONS WITH STRENGTH AND OXIDATION RESISTANCE, DENSE Si3N4: INTERRELATION BETWEEN PHASE EQUILIBRIA, MICROSTRUCTURE AND MECHANICAL PROPERTIES Final Report
F. F. Lange 30 Sep. 1976 54 p
(Contract N00014-74-C-0284; ARPA Order 2697)
(AD-A030408; TR-9) Avail: NTIS HC A04/MF A01 CSCL 11/2

Phase equilibria studies between 1400 C and 1750 C have established three important tie lines in the Si3N4-SiO2-MgO system, viz., Si3N4-MgO, Si3N4-Mg2SiO4, and Si2N2O-Mg2SiO4. Strength measurements at 1400 C for fixed Si3N4 molar contents and varying MgO/SiO2 molar ratios show that the maximum high temperature strengths can be obtained for MgO/SiO2 molar ratios that approach zero and infinity. The oxidation of these materials will be discussed in terms of the compatibility of SiO2 (the oxidation product of Si3N4) and the other phases present in the material. Author (GRA)

DATA SUMMARY: Mole fractions of Si2N4 were calculated at 0.91, 0.833, and 0.775; variables include weight percent MgO/SiO2 molar ratio, flexural strength, mole fraction SiO2, time, weight gain squared, and oxide additions; 5 figures and 1 table include numeric data.

N77-17175# Syracuse Univ., N.Y.
A TECHNOLOGY PLAN FOR ELECTROMAGNETIC CHARACTERISTICS OF ADVANCED COMPOSITES Phase Report, 1 Apr. 1975 - 1 Apr. 1976
J. Allen (South Fla. Univ.), W. Gajda (Notre Dame Univ.), D. Griffin (Adelaide Univ.), R. Harrington, R. Heintz (Rochester Inst. of Technol.), E. Joy (Georgia Inst. of Technol.), J. Lyon (Mich. Univ., Ann Arbor), and W. Walker (Rochester Inst. of Technol.) Griffiss AFB, N. Y. RADC Jul. 1976 160 p
(Contract F30602-75-C-0121; AF Proj. 4540)
(AD-A030507; RADC-TR-76-206; RIT-EE-76-101) Avail: NTIS HC A08/MF A01 CSCL 11/4

The report presents a program for the development of the fundamental technology for the assessment of the electromagnetic compatibility (EMC) effects of the use of advanced composite materials in aircraft. A survey of the electromagnetic impact of the use of advanced composite materials in aircraft is given. Electromagnetic hazards (lightning, nuclear blast EMP, precipitation static and radar) are described and related to the shielding performance of advanced composite materials. In addition the effects of composite materials on antenna performance is discussed. The measurement of basic electrical properties and the definition and measurement of shielding effectiveness is treated in detail. Finally and most importantly, future study tasks are defined which aim to develop electromagnetic environment analysis capability for existing and future aircraft systems using advanced composite materials. Author (GRA)

DATA SUMMARY: Statistics on lightning strikes to aircraft from 1948 to 1970 are presented; variables include peak current,

frequencies, current (amps), time, altitude, strikes/10,000 flying hours, percentage of occurrence, lightning parameters, signal amplitude, and resistance; 7 figures and 2 tables include numeric data.

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N77-17176 Virginia Univ., Charlottesville.
ELECTROCHEMICAL DISINFECTION: A FUNDAMENTAL STUDY Ph.D. Thesis
George Lemuel Cahen, Jr. 1976 83 p
Avail: Univ. Microfilms Order No. 77-151

The process to be described provides a method for the disinfection of microorganisms contained in a liquid, the most common liquid being water or a water base solution containing various chemical additives. The microorganism destruction is effected by electrodes which are connected to an alternating voltage. This alternating voltage causes each electrode to pass through both an anodic and cathodic phase with an induced alternating current being passed through the solution. The voltage, current, and other wave form variables are all set such that disinfection occurs without vigorous electrolytic gases being produced at the electrodes. Dissert. Abstr.

N77-17177 Drexel Univ., Philadelphia, Pa.
AN EXPERIMENTAL AND MECHANISTIC STUDY OF THE REACTIONS OF CARBONYL FLUORIDE WITH HYDROGEN AND WITH CARBON MONOXIDE Ph.D. Thesis
Harry Joseph Gangloff 1977 147 p
Avail: Univ. Microfilms Order No. 76-30033

The decomposition of carbonyl fluoride (COF2), the reaction of carbonyl fluoride with carbon monoxide (CO) and the reaction of carbonyl fluoride with hydrogen (H2) in excess argon were studied behind reflected shock waves. Kinetic data were obtained in the temperature and total pressure ranges 2,600 to 3,300 K and 2.5 to 9.0 atmospheres, respectively, for the COF2 decomposition study, in the temperature and total pressure ranges 2,400 to 3,000 K, 3.3 to 7.7 atmospheres, respectively, for the COF2-CO study, and in the temperature and total pressure ranges 1,800 to 2,700 K and 2 to 12 atmospheres, respectively, for the COF2-H2 study. An empirical relationship for the overall kinetics of the COF2-H2 reaction was determined, and a combined analytical and experimental study was conducted to determine a plausible mechanism for the COF2-H2 reaction. Dissert. Abstr.

N77-17178*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCESS FOR PREPARING HIGHER OXIDES OF THE ALKALI AND ALKALINE EARTH METALS Patent Application
Pasupati Sadhukhan (Occidental Res. Corp.) and Alexis T. Bell, inventors (to NASA) (Calif. Univ., Berkeley) Filed 19 Jan. 1977 16 p Sponsored by NASA
(NASA-Case-ARC-10992-1; US-Patent-Appl-SN-760810) Avail: NTIS HC A02/MF A01 CSCL 07D

High purity inorganic higher oxides of the alkali and alkaline earth metals are prepared by subjecting the hydroxide of the metal to a radio frequency discharge sustained in oxygen. The process is particularly adaptable to the production of high purity potassium superoxide (KO2) by subjecting potassium hydroxide to glow discharge sustained in oxygen under the pressure of about 0.75 to 1.00 torr. NASA

N77-17179*# Kanner (Leo) Associates, Redwood City, Calif.
CONTRIBUTION TO THE STUDY OF CARBON-POTASSIUM SYSTEMS Ph.D. Thesis
B. Carton Washington NASA 2 Feb. 1977 54 p refs Transl. into ENGLISH from "Contrib. a l'Etude des Systemes Carbone-potassium" (Nancy), Sep. 1969 p 1-47
(Contract NASw-2790)
(NASA-TT-F-17374) Avail: NTIS HC A04/MF A01 CSCL 07D

The equipment used and the results obtained in large angle X-ray diffraction and central X-ray scattering studies of potassium-carbon systems are described. The design and operation of the equipment used in thermogravimetric study of potassium-carbon systems at 400-800 C are presented. The thermal evolution of natural graphite-potassium compositions was precisely determined. Data are presented on the porous texture of hard cokes. The data on vitreous carbon indicates that the metal is retained at least partially in the form of insertion compounds. Author

N77-17180*# Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF NITROGEN AND SILICON IN SILICON NITRIDE
A. Ichinose and H. Einaga Washington NASA Feb. 1977 18 p refs Transl. into ENGLISH from J. Ceram. Soc. Japan, v. 83, no. 9, 1975 p 55-60
(Contract NASw-2791)
(NASA-TT-F-17375) Avail: NTIS HC A02/MF A01 CSCL 07D

A simple method for determining silicon and nitrogen in silicon nitride is described. Nitrogen content was established by decomposition with sodium hydroxide, steam distillation and neutralization titration. Silicon was determined by dissolution with sodium potassium carbonate followed by the gravimetric method and heterpoly blue spectrophotometry. The method was applied to the determination of these elements in high purity silicon nitride. Author

N77-17181*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
ELECTROPHORETIC SEPARATOR FOR PURIFYING BIOLOGICALS Annual Report, 19 Aug. 1975 - 19 Aug. 1976
19 Sep. 1976 16 p
(Contract NAS8-31036)
(NASA-CR-150180) Avail: NTIS HC A02/MF A01 CSCL 07D

This technique separates a single narrow zone of sample mixture in an electrolyte medium into many zones containing a single component of the mixture and electrolyte between them. Since the densities of the separated zones generally differ from that of the intervening medium, such systems are gravitationally unstable and stabilization is required. The various techniques for stabilization include using the capillary space provided by thin films, the interstices of solid material such as filter paper and a variety of gel-forming substances. Author

N77-17182*# Scientific Translation Service, Santa Barbara, Calif.
ELECTRONIC MODELS OF CARBON
A. Marchand Washington NASA Feb. 1977 24 p refs Transl. into ENGLISH from the book "Les Carbones" v. 1, chapter 6, Paris, Masson, 1965 p 233-248
(Contract NASw-2791)
(NASA-TT-F-17313) Avail: NTIS HC A02/MF A01 CSCL 07D

Several electronic models of carbon are described, and a critical examination is made of them. The number and variety of models proposed showed that there is no single model valid for all the carbons. Author

N77-17183*# Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF ANTHRACENE SEMI-COKES: THE RELATIONSHIP BETWEEN THEIR STRUCTURAL AND ELECTRONIC PROPERTIES Ph.D. Thesis - Orleans Univ.
Christian Simon Washington NASA Feb. 1977 78 p refs Transl. into ENGLISH of "Etude des Semi-cokes d'Anthracenei Relation entre leurs Proprietes Struct. et Electron." (France) 1974 51 p
(Contract NASw-2790)
(NASA-TT-F-17381) Avail: NTIS HC A05/MF A01 CSCL 07D

Correlated X-ray diffraction and electron paramagnetic

resonance analyses are used to show the initial stages in the organization of anthracene cokes. Author

N77-17184# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE COMBUSTION OF LIQUID FUEL IN TUNNEL BURNERS
Y. Goldman, A. Lipshitz, and Y. Manheimer-Timnat Oct. 1976 51 p refs Sponsored by the Natl. Council for Research and Development, Israel and the KFA Juelich, West Germany
(TAE-293) Avail: NTIS HC A04/MF A01

After discussing the general characteristics of tunnel burner combustion, the droplet vaporization process is studied numerically and it is shown that recirculation is very important. The influence of four different tunnels on the performance of burners in a model industrial furnace is investigated experimentally. The best combustion quality is achieved by the tunnel, which produces the most favorable recirculation pattern, as corroborated by water model experiments. Author

N77-17185# Brookhaven National Lab., Upton, N.Y.
PRELIMINARY DESIGN AND ANALYSIS OF A PROCESS FOR THE EXTRACTION OF LITHIUM FROM SEAWATER
M. Steinberg and V. D. Dang Sep. 1975 34 p refs Presented at Symp. on US Lithium Resources and Requirements by the Year 2000, Lakewood, Colorado, 22 Jan. 1976
(BNL-20535-R; Conf-760112-4) Avail: NTIS HC A03/MF A01

A preliminary process design for the extraction of lithium from seawater is presented. Seawater is evaporated by solar energy to increase the concentration of lithium and to decrease the concentration of other cations in the bittern which then passes into a 50 ion exchange bed for cation adsorption. Lithium ions are eluted with dilute hydrochloric acid forming an aqueous lithium chloride which is subsequently concentrated and electrolyzed. Production cost of the process is estimated to be in the range of 2.2 to 3.2 cents/g Li. ERA

N77-17186# Oak Ridge National Lab., Tenn.
STRUCTURE OF LIQUIDS
A. H. Varten 1976 20 p refs Presented at Conf. on Neutron Scattering, Gatlinburg, Tenn., 6 Jun. 1976 Sponsored by ERDA
(CONF-760601-1) Avail: NTIS HC A02/MF A01

The structure of most liquids is completely described by probability functions of position and orientation. Knowledge of the pair correlation functions and the intermolecular potential is sufficient in principle for the calculation of all thermodynamic properties by standard methods of statistical mechanics. The Fourier transform of the pair correlation function is closely related to the liquid structure function which can be obtained from the experimentally accessible static scattering cross section. For monatomic fluids the agreement between experiment and the general theory is, to this date, quite satisfactory. ERA

N77-17187# Cincinnati Univ., Ohio. Dept. of Physics.
THERMAL MAGNETORESISTANCE OF POTASSIUM
R. S. Newrock and B. W. Maxfield (Cornell Univ., Ithaca, N. Y.) 1976 39 p refs Sponsored by ERDA
(COO-3150-36) Avail: NTIS HC A03/MF A01

Two interesting relations were found between corresponding coefficients in the electrical and thermal magnetoresistance: the Weidmann-Franz law relates A0 to the Kohler slope of the electrical magnetoresistance, and the temperature dependent portions of the electrical and thermal Kohler slopes are both proportional to the electron-phonon scattering contribution to the corresponding zero-field resistance. This is evidence that inelastic scattering is very important in determining the temperature dependent linear magnetoresistances. ERA

N77-17188# California Univ., Berkeley. Lawrence Berkeley Lab.
MEASUREMENT OF NO2 CONCENTRATION IN COMBUSTION USING FLUORESCENCE EXCITED BY AN ARGON-ION LASER
Y. Agarwal, T. Hadeishi, and F. Robben Jan. 1976 6 p refs Presented at 14th AIAA Aerospace Sci. Meeting, Washington, D.C., 26 Jan. 1976
(Contract W-7405-eng-48)
(LBL-4466; Conf-760102-6) Avail: NTIS HC A02/MF A01

Preliminary results on the measurement of NO2 in a premixed hydrogen-air flame are reported, using a laser excited fluorescence detector. Measurements of the effective broadband fluorescence (6,700 to 7,500 A) emission cross sections excited by five Ar+ laser lines were carried out using NO2 air mixtures in the 1-1,000 ppM range of concentrations, under atmospheric pressure and temperature conditions. Fluorescence intensity was linear with NO2 concentration in the range 1-500 ppM at total pressure of 1 atm and room temperature. ERA

N77-17189# Battelle Pacific Northwest Labs., Richland, Wash.
HIGH RESOLUTION X- AND GAMMA-RAY COINCIDENCE SPECTROMETRY
F. P. Brauer, J. E. Fager, and R. W. Goles 26 Mar. 1976 23 p refs
(Contract E(45-1)-1830)
(BNWL-SA-5647) Avail: NTIS HC A02/MF A01

A data acquisition and analysis system was developed for high resolution coincidence spectrometry. The system hardware and software are described together with the system capabilities. The sensitivity and selectivity of three coincidence detector systems were experimentally evaluated. The NaI(Tl)-Ge(Li) system was found to have about the same sensitivity, based on a 5,000 minute count, as the all-NaI(Tl) system with improved selectivity. The applications of Ge(Li)-Ge(Li) detectors are limited by their low efficiency. The utilization of time as a third parameter was investigated by correlation studies of the coincidence event energies and the time interval between signals from the two detectors. ERA

N77-17190# Siemens A.G., Erlangen (West Germany). Systemtechnische Entwicklung.
FUNDAMENTAL RESEARCH IN THE FIELD OF ELECTRON BEAM MICROANALYSIS. SCANNING AUGER ELECTRON ANALYZER WITH FIELD MISSION GUN Final Report
Hans Neff and Ulrich Weber Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1976 49 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-227)
(BMFT-FB-T-76-44) Avail: NTIS HC A03/MF A01; ZLDI, Munich, DM 10,10

The principle and design of a scanning auger electron microanalyzer developed during the course of the NT 22 study are outlined. The analyzer uses an electron gun with a field emission cathode and UH vacuum within the specimen chamber. Scanning pictures of the distribution of single chemical elements on the specimen surface may be taken. The resolution is about 0.5 microm (beam diameter). Examples demonstrate the high sensitivity of the instrument, especially for light elements. Important features and limitations of auger electron microanalysis and applications are discussed. Author (ESA)

N77-17191# European Space Research and Technology Center, Noordwijk (Netherlands).
DESIGN AND DEVELOPMENT OF A FLAMMABILITY TESTING EQUIPMENT
M. E. M. Debeir, G. Gourmelon, and M. D. Judd Paris ESA Nov. 1976 27 p In FRENCH; ENGLISH summary
(ESA-TM-164-ESTEC) Avail: NTIS HC A03/MF A01

A flammability test facility for spacecraft materials, based on the NASA-NHB-8060 1.A specification, is dealt with. The selection and testing of materials with regard to their flammability properties is essential to manned space missions such as Spacelab. The NASA specification describes three test methods, two relating to materials in general (upward and downward flame propagation) and the third to electrical insulation and equipment. Test equipment and procedures and their practical realization are described. ESA

N77-17192# New York Univ., N.Y. Dept. of Chemistry.
INSTRUMENTATION FOR He-I PHOTOELECTRON SPECTROSCOPY OF LIQUIDS
L. Nemec, H. J. Chia, and P. Delahay Jul. 1976 16 p refs Submitted for publication
(Contract N00014-75-C-0397; NR Proj. 051-258)
(AD-A027865; TR-4) Avail: NTIS HC A02/MF A01 CSCL 14/2

This supplement to a manuscript to be submitted for publication covers the following aspects of instrumentation: modified cell, He-I lamp, block diagrams of electronics.
Author (GRA)

N77-17193# Air Force Missile Development Center, Holloman AFB, N.Mex.
A VOLUMETRIC GAS ADSORPTION SYSTEM FOR THE CHARACTERIZATION OF THE SURFACES OF ADHERENDS AND REINFORCING FIBERS Final Report, Apr. 1972 - Apr. 1975
Lawrence T. Drzal and Judith A. Mescher Wright-Patterson AFB, Ohio AFML May 1976 49 p refs
(AF Proj. 7340)
(AD-A028050; AFML-TR-76-84) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report documents the components, construction, and operating procedures of a gas volumetric adsorption apparatus constructed to provide surface energetic information about reinforcement and adherend surfaces used in advanced composites and bonded structure. The information obtained with this technique will provide the basis for understanding polymer-surface interactions and interfacial durability. Author (GRA)

N77-17194# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
A PROBLEM IN FIRE SAFETY: FLAME SPREADING ACROSS LIQUID FUELS Final Report
R. L. Dryer, I. Glassman, and W. A. Sirignano 15 Sep. 1976 30 p refs
(Grant NSF AEN-75-14285)
(PB-259127/9; PUAMS-1308; NBS-GCR-76-79) Avail: NTIS HC A03/MF A01 CSCL 13L

A brief summary of experimental and theoretical work on flame spreading across liquid fuels is presented. The importance of surface tension driven flows ahead of the flame front in controlling flame spread across liquids at temperatures below the flash point was demonstrated experimentally. Variations in the temperature of the liquid surface are attributed to eddies in the gas phase ahead of the flame front. These eddies also play a role in flame propagation across solid combustibles. GRA

N77-17300# Osaka Univ. (Japan). Dept. of Electrical Engineering.
ELECTRICAL PROPERTY OF POLYMERIC SULFUR NITRIDE (SN)x
In its Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 455 refs (For primary document see N77-17291 08-31)
(Rept-1318) Avail: NTIS HC A10/MF A01

N77-17302# Osaka Univ. (Japan). Dept. of Electrical Engineering.
EFFECT OF SURFACTANT ON THE FLUORESCENCE OF DYE SOLUTION
Jun-ichic Nakata, Takeshi Imura, and Kazuo Kawabe *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 471-476 refs (For primary document see N77-17291 08-31)
(Rept-1320) Avail: NTIS HC A10/MF A01

N77-17682*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THREE MODEL SPACE EXPERIMENTS ON CHEMICAL REACTIONS
Philomena Grodzka (Lockheed Missiles and Space Co., Huntsville, Ala.) and Barbara Facemire *In its* Bioprocessing in Space Jan. 1977 p 67-76 refs (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-17195 Northwestern Univ., Evanston, Ill.
THE STRUCTURE OF COMPOSITION-MODULATED COPPER-NICKEL AND GOLD-SILVER THIN FILMS Ph.D. Thesis
Andrew Joseph Purdes 1976 96 p
Avail: Univ. Microfilms Order No. 76-1333

The structure of [111] textured, vapor-deposited films of CuNi and AuAg having composition modulations between 0.8 and 5.0 nm was examined using X-ray diffraction and transmission electron microscopy. The average planar spacing p along the modulation and the fractional deviation from this average eta were measured as a function of composition amplitude A and wavelength Lambda. For both the CuNi and AuAg systems, the amplitude dependence of p was much larger than predicted by the classical models. The quantity eta(O) = eta/A was independent of wavelength for the AuAg system. For the CuNi system, however, eta(O) was a strong function of wavelength, exhibiting an increase for Lambda < 3nm. This increase of eta(O) for the CuNi system correlated with a previously observed increase (approximately 100 percent) in Young's modules in the same wavelength range. Dissert. Abstr.

DATA SUMMARY: Data summary not prepared due to nonavailability of complete document for processing.

N77-17196 Northwestern Univ., Evanston, Ill.
NONISOTHERMAL INITIAL STAGE SINTERING OF SILVER Ph.D. Thesis
Stephen Oliver Brennom 1976 191 p
Avail: Univ. Microfilms Order No. 77-1219

A method of analyzing nonisothermal sintering data has been proposed that makes it possible to determine the dominant shrinkage producing diffusion mechanism and to identify the presence of other mechanisms which produce neck growth or shrinkage in excess of that expected from the shrinkage producing diffusion mechanism. Nonisothermal initial stage sintering of silver has been studied empirically with respect to heating rate particle size, green density, material purity and atmosphere (O2, Ar, N2 and H2). The sintering of silver in oxygen can be described as a combination of grain boundary, volume and surface diffusion with grain boundary diffusion being the dominant shrinkage producing mechanism. Experimental data for sintering in oxygen are in quantitative agreement with computer synthesized data. The sintering of silver in other atmospheres exhibits excess shrinkage. Dissert. Abstr.

DATA SUMMARY: Data summary not prepared due to nonavailability of complete document for processing.

N77-17197*# Battelle Columbus Labs., Ohio.
LASER SHOCKING OF 2024 AND 7075 ALUMINUM ALLOYS
Allen H. Clauer, Barry P. Fairand, and John E. Slater 11 Feb. 1977 111 p refs
(Contract NAS1-14047)
(NASA-CR-145132) Avail: NTIS HC A06/MF A01 CSCL 11F

The effect of laser generated stress waves on the microstructure, hardness, strength and stress corrosion resistance of 2024 and 7075 aluminum alloys was investigated. Pulsed CO2 and neodymium-glass lasers were used to determine the effect of wavelength and pulse duration on pressure generation and material property changes. No changes in material properties were observed with CO2 laser. The strength and hardness of 2024-T351 and the strength of 7075-T73 aluminum alloys were substantially improved by the stress wave environments generated with the neodymium-glass laser. The mechanical properties of 2024-T851 and 7075-T651 were unchanged by the laser treatment. The correlation of the laser shock data with published results of flyer plate experiments demonstrated that a threshold pressure needed to be exceeded before strengthening and hardening could occur. Peak pressures generated by the pulsed laser source were less than 7.0 GPa which was below the threshold pressure required to change the mechanical properties of 2024-T851 and 7075-T651. Corrosion studies indicated that laser shocking increased the resistance to local attack in 2024-T351 and 7075-T651. Author

DATA SUMMARY: Diverse data are presented; variables include yield strength, tensile strength, elongation, reduction in area, laser power, time, pressure, energy density, hardness.

N77-17198*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CORROSION INHIBITORS FOR SOLAR HEATING AND COOLING SYSTEMS
T. S. Humphries and G. E. DeRamus, Jr. Washington Feb. 1977 22 p
(NASA-TN-D-8409; M-199) Avail: NTIS HC A02/MF A01 CSCL 11F

Problems dealing with corrosion and corrosion protection of solar heating and cooling systems are discussed. A test program was conducted to find suitable and effective corrosion inhibitors for systems employing either water or antifreeze solutions for heat transfer and storage. Aluminum-mild-steel-copper-stainless steel assemblies in electrical contact were used to simulate a multimetallic system which is the type most likely to be employed. Several inhibitors show promise for this application. Author

DATA SUMMARY: Effectiveness of corrosion inhibiting solutions containing sodium compounds for aluminum and mild steel sheets at room temperatures and elevated temperatures; variables include degree of chemical attack, solution pH, length to first visual attack, corrosive characteristics, weight loss, and temperature effects; no figures and 6 tables include numeric data.

N77-17199# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
SUPERPLASTICITY OF HIGH-TEMPERATURE NICKEL-BASE SUPERALLOYS MADE BY POWDER-METALLURGY
F. Schubert 1976 18 p refs Transl. into ENGLISH from West German report "Thyssen Technische Berichte", 6(1), 1974 p 53-58
(NRC/CNR-TT-1890; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The conditions for superplastic behavior for hot extruded metal powder compacts of the nickel alloys ATS 380 and ATS 290 are described; i.e. a very fine grain duplex structure of gamma mixed crystal and a gamma prime phase as well as a low deformation rate in the temperature range between 900 and 1100 C. The results of hot tensile tests and creep rupture tests, carried out on superplastically deformed and heat treated samples, show better values than those of conventionally produced sample material, up to temperatures of about 700 C. It is suggested that superplastic deformation could be used for the production of turbine discs from high nickel alloys, as opposed to production in the form of high quality castings. Author

DATA SUMMARY: Production conditions and test results for superplastic alloys; variables include temperature, elongation, time, stress, reduction in area, fracture strength, superplastic deformation, strain rate; 5 figures and 5 tables include numeric data.

N77-17200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REACTION DIFFUSION IN THE NICKEL-CHROMIUM-ALUMINUM AND COBALT-CHROMIUM-ALUMINUM SYSTEMS
Stanley R. Levine Washington Feb. 1977 67 p refs Prepared in cooperation with Army Air Mobility Lab., Moffett Field, Calif.
(NASA-TN-D-8382; E-8835) Avail: NTIS HC A04/MF A01 CSCL 11F

The effects of MCrAl coating-substrate interdiffusion on oxidation life and the general mutliphase, multicomponent diffusion problem were examined. Semi-infinite diffusion couples that had sources representing coatings and sinks representing gas turbine alloys were annealed at 1,000, 1,095, 1,150, or 1,205 C for as long as 500 hours. The source and sink aluminum and chromium contents and the base metal (cobalt or nickel) determined the parabolic diffusion rate constants of the couples and predicted finite coating lives. The beta source strength concept provided a method (1) for correlating beta recession rate constants with composition; (2) for determining reliable average total, diffusion, and constitutional activation energies; and (3) for calculating interdiffusion coefficients. Author

DATA SUMMARY: Driving potentials, phase fields, and layer growth contants for 28 Al source alloys are presented, along with layer growth analysis of Ni and Co base alloys; variables include Al content weight percent, Cr content weight percent, distance, Knoop hardness number, time, recession, source strength, recession rate constant, growth, and total depleted zone growth; 13 figures and 5 tables include numeric data.

N77-17201*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOT CORROSION OF S-57, 1 COBALT-BASE ALLOY
Gilbert J. Santoro Washington Feb. 1977 34 p refs
(NASA-TN-D-8395; E-8876) Avail: NTIS HC A03/MF A01 CSCL 11F

A cobalt base alloy, S-57, was hot corrosion tested in Mach 0.3 burner rig combustion gases at maximum alloy temperatures of 900 and 1000 C. Various salt concentrations were injected into the burner: 0.5, 2, 5, and 10 ppm synthetic sea salt and 4 ppm sodium sulfate (Na_2SO_4). S-57 underwent accelerated corrosion only under the most severe test conditions, for example, 4 ppm Na_2SO_4 at 900 C. The process of the accelerated corrosion was primarily sulfidation. Author

DATA SUMMARY: High temperature sulfur-sea salt corrosion in Mach 0.3 burner rig combustion gases; variables are temperature, corrosive penetration depth, exposure time, sulfur content, sea salt concentration, burner rig flame fuel, oxidant mass ratio, oxide phase, alloy temperature, weight of deposit, and scale thickness; 8 figures and 6 tables include numeric data.

N77-17202# Aqua-Chem, Inc., Milwaukee, Wis.
MATERIALS FAILURE IDENTIFICATION MANUAL FOR SEA WATER DESALINATION PLANTS
ORNL Apr. 1976 130 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5001) Avail: NTIS HC A07/MF A01

The most common forms of corrosion and component failures which occur in distillation desalting plants are described. The manual was prepared to aid distillation plant operators and owners in the diagnosis and prevention of corrosion problems.
Author (ERA)

DATA SUMMARY: No numeric data are presented.

N77-17203# Sandia Labs., Livermore, Calif.
DEUTERIDING OF THIN TITANIUM FILMS: THE EFFECT OF CARBON MONOXIDE SURFACE CONTAMINATION
M. E. Malinowski Feb. 1976 20 p refs Presented at 2d Intern. Conf. on Surface Effects in Controlled Fusion Devices, San Francisco, 16 Feb. 1976
(Contract AT(29-1)-789)
(SAND-75-8759; Conf-760209-23) Avail: NTIS HC A02/MF A01

The effect of adsorbed CO on the deuteriding of thin titanium films at room temperature was measured at D2 pressures between 10 to 25 mtorr on films contaminated with CO exposures ranging between approximately 10 to the -8 power torr-seconds (clean) to .0001 torr-seconds. In all measurements, for deuterium/titanium atom ratios greater than .2, the deuteriding appeared to be initally limited by the sticking of D2 on the clean or contaminated titanium deuteride surface; the effective sticking coefficient on a clean titanium deuteride surface was approximately .003, while on a surface contaminated with .0001 torr-seconds of CO, the coefficient was reduced to approximately .0002. The pumping speeds of Ti films were dramatically different when the films were evaporated over TiD2. These changes were attributed to the presence of deuterium which diffused from the substrate film into the overlayer film. Author (ERA)

DATA SUMMARY: Titanium is measured that deposited on stainless steel and TiD2 at 870 A thickness; variables include pumping speed and atom ratio; 3 figures include numeric data.

N77-17204# Cornell Univ., Ithaca, N.Y.
DEFECTS IN METAL CRYSTALS Progress Report, 1 May 1975 - 30 Apr. 1976

D. N. Seidman Feb. 1976 42 p refs
(Contract E(11-1)-3158)
(COO-3158-48) Avail: NTIS HC A03/MF A01

Emphasis was on use of different irradiating species (300-700 eV Xe(+) ions, 20-30 keV W(+) ions, 20-30 keV Mo(+) ions, and fast neutrons) to introduce both vacancies and interstitials in Mo, W, Au, Pt-(Au), W-(Re), Mo(Ti), Ni4Mo, and low swelling and commercial 316 stainless steels. The following are reported: (1) an in-situ field ion microscope study of ion irradiated tungsten and tungsten alloys (W-Re); (2) a review of irradiated or quenched tungsten and tungsten alloys by field ion microscopy; (3) a review of field-ion microscopy studies of the defect structure of the primary state of damage of irradiated metals; (4) an in-situ field ion microscope study of the recovery behavior of ion irradiated molybdenum; and (5) a field ion microscope study of the recovery behavior in ion irradiated platinum-0.10, 0.62, and 4.0 at. percent gold alloys. ERA

DATA SUMMARY: Experimental W(+3) isotopic abundances are compared to actual isotopic abundances; variables include fraction of defects per 5K interval, temperature, number of events, mass to charge ratio, AMU range, and number of atoms; 6 figures and 6 tables include numeric data.

N77-17205# California Univ., Berkeley. Lawrence Berkeley Lab.
FILAMENTARY NIOBIUM-TIN SUPERCONDUCTORS FABRICATED BY A POWDER METALLURGY APPROACH
Kanithi Hemachalam Feb. 1976 100 p refs
(Contract W-7405-eng-48)
(LBL-4181) Avail: NTIS HC A05/MF A01

Procedures are described for making superconducting tapes and wires containing filaments for the A-15 compound, Nb3Sn, by powder metallurgy techniques. The Nb3Sn filaments, typically 1-5 m thick, are formed by a short heat treatment. The effects of process variables on the microstructure of the tapes and wires were investigated. Microstructural aspects were examined by optical metallography and transmission electron microscopy. A pulsed field technique was used to determine the critical current density, J/sub c/, at 4.2 K as a function of transverse magnetic field up to 170 kG. The J/sub c/ of the conductors are related to their individual filament morphologies resulting from the different thermo-mechanical histories. The effect of heat treatment conditions on critical current and transition temperature, T/sub c/, is presented. ERA

DATA SUMMARY: Effect of heat treatment conditions on superconducting tapes containing Nb3Sn filaments; variables include critical current density, transverse magnetic fields, filament thickness, reduction ratio, transition temperature, reaction time, and reaction temperature; 15 figures and 2 tables include numeric data.

N77-17206# Atomics International, Golden, Colo.
STRESS-CORROSION CRACKING OF A URANIUM 6-WEIGHT PERCENT NIOBIUM ALLOY
Robert L. Kochen, R. Mah, and R. J. Jackson 29 May 1976 18 p refs
(Contract AT(29-1)-1106)
(RFP-2429) Avail: NTIS HC A02/MF A01

The stress-corrosion cracking (SCC) behavior of U-6 wt percent Nb in three different heat-treated conditions was investigated. The three heat treatments were: (1) solution quenched (the nonaged condition); (2) solution quenched and aged 6 hours at 250 C (the underaged condition); and (3) solution quenched and aged 80 minutes at 600 C (the overaged condition). The SCC tests utilized smooth, dead weight loaded, static tensile specimens exposed to nitrogen-saturated or oxygen-saturated water containing 50 ppM chloride ions. The alloy in the solution-quenched condition was not susceptible to SCC when loaded to 90 percent of yield strength in either the oxygen or nitrogen-saturated chloride solutions. The underaged material (6 hours at 250 C) was susceptible to SCC in oxygen or nitrogen-saturated water containing 50 ppM chloride ions. The underaged material was more susceptible to cracking in the oxygen-saturated solution than in the nitrogen-saturated solutions. ERA

DATA SUMMARY: Results of 25 samples undergoing stress corrosion cracking tests are presented for three types of U-Nb metals (overaged, underaged, and solution quenched); variables include stress, environment, time to failure, unexposed-unstressed tensile, exposed-unstressed tensile, exposed-stressed tensile, applied tensile stress, solution quenched, overaged, and underaged; 5 figures and 2 tables include numeric data.

N77-17207# Ames Lab., Iowa.
ABSOLUTE THERMAL EXPANSION OF COPPER AND ALUMINUM BETWEEN 5 K AND 330 K
Frederick Robert Kroeger, Jr. Feb. 1976 121 p refs
(Contract W-7405-eng-82)
(IS-T-655-Rev) Avail: NTIS HC A06/MF A01

Theoretical and experimental results of experiments on thermal expansion of Al and Cu are presented. Experimental apparatus and procedures are described. Results are presented in graphs and plots and discussed. ERA

DATA SUMMARY: Least squares fit coefficients for aluminum and copper thermal expansion coefficients; variables include temperature, lattice Gruneisen parameter, and smoothed values; 11 figures and 10 tables include numeric data.

N77-17208# Addis Translations International, Portola Valley, Calif.
INVESTIGATIONS OF THE TERNARY URANIUM-ZIRCONIUM-OXYGEN SYSTEM
Constantin Politis Jun. 1976 63 p refs Transl. into ENGLISH of report KFK-2167, Gesellschaft fuer Kernforschung M.B.H., Karlsruhe Nuclear Research Center (West Germany), Oct. 1975 63 p Sponsored by ERDA
(SAND-76-6027; KFK-2167) Avail: NTIS HC A04/MF A01

Boundaries of the phase fields in the U-Zr-O system were determined by means of specimens prepared by a powder metallurgical method at 1000, 1500, and 2000 C. It appears that the UO2-Zr section, corresponding to the contact in LWR's between fuel and cladding, is not quasi-binary but that UO2 alpha Zr(O) and the (gamma-U, beta-Zr) solid solution occur as equilibrium phases at lower temperatures and (U, Zr)O/sub 2-x/ and melt, respectively, at elevated temperatures. UO2 alpha Zr(O) and 30 at. percent oxygen are in equilibrium. The eutectic temperature in the alpha-Zr(O)-UO2 quasi-binary system is 1800 + 20 C and the distectic temperature at 2400 + 30 C. Beginning of melting in the UO2-ZrO2-U-Zr subsystem of the U-Zr-O system was observed with a melting point determination apparatus. With the aid of additional high temperature X-ray diffractometry of Zr-O specimens and considering all literature data, an improved Zr-O equilibrium phase diagram is proposed. Author (ERA)

DATA SUMMARY: The UO2 and ZrO2 systems are compared in phase diagrams; variables include temperature, atomic percent, weight percent, mole fraction, and mole percent; 8 figures and 1 table include numeric data.

N77-17209# Battelle Pacific Northwest Labs., Richland, Wash.
EFFECT OF HELIUM ON VOID SWELLING IN VANADIUM
J. L. Brimhall and E. P. Simonen 1976 22 p refs Presented at the meeting of the Am. Nucl. Soc., San Francisco, Apr. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5601; Conf-760442-1) Avail: NTIS HC A02/MF A01

Results for 46-MeV Ni(6+), 5-MeV Ni(2+), and 200-keV He(+) irradiations demonstrate that the role of helium in void nucleation is highly dependent on the other experimental parameters: ion dose rate, temperature, and vacancy supersaturation. In this regard, the results are in at least qualitative agreement with the nucleation theory of Wiedersich and Katz. Values of the basic parameters must be better known before quantitative comparisons can be made. It is shown that it is important to have helium in the material when planning ion irradiation experiments at low dose rates and/or high temperatures. At high dose rates, the damage in terms of void swelling is not dependent on the presence of helium. At the high dose rates, therefore, the simulation experiment may be just as valid with or without helium. Author (ERA)

DATA SUMMARY: Void parameters in vanadium for different

conditions of helium and nickel bombardment; variables include atomic displacement per atom, distance from bombarded surface, dose rate, void parameter, void density, void volume fraction, void nucleation rate, and vacancy formation energy; 3 figures and 1 table include numeric data.

N77-17210# Battelle Pacific Northwest Labs., Richland, Wash.
COMPUTING THE TIME DEPENDENCE OF VOID SIZE DISTRIBUTIONS DURING IRRADIATION AND ANNEALING
E. P. Simonen and J. L. Brimhall 1976 18 p refs Presented at the Conf. on Computer Simulation for Materials Applications, Gaithersburg, Md., 19 Apr. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5520; Conf-760421-5) Avail: NTIS HC A02/MF A01

The Wagner-Lipshitz-Slyosov theory for describing the response of particle size distributions to annealing was modified and applied to the analysis of void size distributions. Limits of the model which prevent a complete interpretation of rate controlling mechanisms were overcome using a numerical solution for the combined influences of volume diffusion, surface kinetics, and irradiation-induced point defects. A computer program was written which calculates and updates with time the necessary kinetic and material parameters. The time dependence of the radius distribution function is determined from a finite difference solution to the continuity equation. The program provides wide latitude in simulating and analyzing the dependence of swelling and void growth kinetics on point defect kinetics, point defect sink efficiencies, and variations in irradiation and annealing history. The consequences of including the size distribution in the kinetic analysis were calculated for voids in molybdenum and compared with theoretical predictions. Author (ERA)

DATA SUMMARY: Experimental and numerical analyses of void growth; variables include displacement rates, temperature, normalized distribution functions, void radius, radius/average radius, time, percent void swelling; 8 figures include numeric data.

N77-17211# Lehigh Univ., Bethlehem, Pa. Dept. of Metallurgy and Materials Science.
DIFFUSION CONTROLLED PHASE GROWTH IN THE TERNARY SYSTEM Fe-Ni-Co
A. Moren, E. Randich, and J. I. Goldstein 1976 12 p refs Presented at Conf. on Computer Simulation for Materials Applications, Gaithersburg, Md., 19 Apr. 1976 Sponsored by ERDA
(SAND-76-5529; Conf-760421-4) Avail: NTIS HC A02/MF A01

In a three component system, the equations for the fluxes of the two solute elements are given by Onsager's extension of Fick's first and second laws. During phase growth, there is a mass balance for the two solute elements 1 and 2 at the precipitate/matrix interface. The two mass balances are related since the rate of movement of the interface, d xi/dt, must be the same for each element d xi/sub i//dt. The mass balance equations can be simultaneously satisfied by the selection of appropriate interface compositions and velocities. A Newton-Raphson method is used to determine interface compositions and velocities from the coupled mass balance equations. The differential equations describing the diffusion fluxes are approximated by the Crank-Nicolson finite difference equation with an incorporation of the Murray-Landis variable grid space transformation. The finite difference approximations to the flux equations are in the form of tridiagonal matrix expressions which are solved using a standard algorithm. Author (ERA)

DATA SUMMARY: Space grid, profiles, boundary conditions, and terminology in the simulation of gamma precipitate growth in alpha matrix; variables include weight percent cobalt, weight percent nickel, and distance (microns); 5 figures include numeric data.

N77-17212# Sandia Labs., Albuquerque, N.Mex.
PREVENTION OF GALVANIC CORROSION AND ELECTROCHEMICAL BEHAVIOR OF SELECTED STRUCTURAL MATERIAL
Steven L. Pohlman 1976 32 p refs Presented at the Intern. Corrosion Forum devoted exclusively to the Protection and Performance of Materials, Houston, 22 Mar. 1976 Sponsored by ERDA
(SAND-75-5901; Conf-760309-2) Avail: NTIS HC A03/MF A01

Severe galvanic corrosion was observed in 7075 aluminum, passivated 304 stainless steel, and gold plated beryllium copper couples exposed to a Cl(-) environment. Cadmium plating and chromate treating the beryllium copper and stainless steel and anodizing the aluminum dramatically reduces the severity of the attack. Electrochemical measurements were employed to predict the galvanic effects between HP-9-4-20 (steel 9 percent Ni, 4 percent Co., .20 percent C) and Ti-6-4 (6 percent Al, percent V) and results indicate the corrosion will not be accelerated due to the cathodic current characteristics of Ti-6-4 as long as the exposed surface areas are similar in size. ERA

DATA SUMMARY: Four polarization curves are presented, two of which are testing specimens at room temperature; variables include polarization characteristics, temperature effects, and concentration effects; 4 figures include numeric data.

N77-17213# Sandia Labs., Albuquerque, N.Mex.
HYBRID MICROCIRCUIT METALLIZATION SYSTEM FOR THE SLL MICRO ACTUATOR
R. E. Hampy, G. L. Knauss, E. E. Komarek, D. K. Kramer, and J. Villanueva Mar. 1976 60 p refs
(Contract AT(29-1)-789)
(SAND-75-0313) Avail: NTIS HC A04/MF A01

A thin film technique was developed for the SLL, micro actuator in which both gold and aluminum can be incorporated on sapphire or fine grained alumina substrates in a two level metallization system. Tungsten is used as a lateral transition metal permitting electrical contact between the gold and aluminum without the two metals coming in physical contact. Silicon dioxide serves as an insulator between the tungsten and aluminum for crossover purposes, and vias through the silicon dioxide permit interconnections where desired. Tungsten-gold is the first level conductor except at crossovers where tungsten only is used and aluminum is the second level conductor. Sheet resistances of the two levels can be as low as 0.01 ohm/square. Line widths and spaces as small as 0.025 mm can be attained. A second layer of silicon dioxide is deposited over the metallization and opened for all gold and aluminum bonding areas. ERA

DATA SUMMARY: Diverse data are presented; variables include length, thickness, electrical conductivity, temperature, time, capacitance, breakdown voltage, area.

N77-17214# California Univ., Berkeley. Lawrence Berkeley Lab.
EXPERIMENTAL INVESTIGATION OF DENSIFICATION OF POWDERED A15 PHASE IN THE SYSTEM Nb-Al-Ge M.S. Thesis
D. P. Modi Feb. 1976 38 p refs
(Contract W-7405-eng-48)
(LBL-4173) Avail: NTIS HC A03/MF A01

An investigation of the densification of precompounded powder of the A15 phase Nb3(Al,Ge) was made. The influence of various parameters such as additives, temperature, pressure and time in sintering did not produce sufficient density, the hot pressing technique was used. By hot pressing at 1450 C for 1/2 hour under 6 ksi pressure, about 95 percent densification was achieved. ERA

DATA SUMMARY: A sample of Nb-Al-Ge powder was compacted, sintered, hot pressed and then density measurements were made; variables include actual temperature, measured temperature, relative density, sintering temperature, time, and pressure; 4 figures and 1 table include numeric data.

N77-17215# Tennessee Univ., Knoxville. Dept. of Chemical and Metallurgical Engineering.
MICROSTRUCTURAL STABILITY OF POST-TREATED WELDMENTS OF TYPE 316 AND 16%Cr-8%Ni-2%Mo AUSTENITIC STAINLESS STEEL FILLER METALS
J. A. Scott and J. E. Spruiell 1976 40 p refs Sponsored by ERDA

(TID-26995) Avail: NTIS HC A03/MC A01

The inter-relations between ferrite content, overall alloy composition, and alloy history in determining the rate, amount, and morphology of intermetallic phase formation in 16-8-2 and 316 stainless steel weld metals were investigated. It was found that the rate formation of sigma and chi phases was controlled by processes occurring at the ferrite-austenite interfaces. These processes override the mechanisms responsible for enhanced rates of precipitation in fully austenitic wrought-annealed samples which had been cold worked prior to aging. ERA

DATA SUMMARY: Aging studies of pretreated and as welded samples; variables include voltage, current, ferrite number, pretreatment temperature, aging temperature, weight percent, tensile strength, yield strength, elongation, time; 1 figure and 6 tables include numeric data.

N77-17216# Case Western Reserve Univ., Cleveland, Ohio.
MATERIALS RESEARCH AND EVALUATION FOR GEOTHERMAL CORROSION ENVIRONMENTS Progress Report, 15 Dec. 1974 - 15 Dec. 1975
A. R. Troiano and R. F. Hehemann Dec. 1975 11 p refs
(Contract E(11-1)-2602)
(COO-2602-2) Avail: NTIS HC A02/MF A01

Bent beam and self-stressed specimens were employed and yielded results consistent with other types of specimens reported in the literature. All tests were conducted in the standard NACE, H2S environment for initial screening and then in a 20 percent NaCl modified NACE solution. Among the higher strength corrosion resistant alloys, K Monel at 135 ksi yield strength did not fail in either environment at temperatures up to 425 F stressed at the yield strength. Age hardenable A286 failed at 325 F when stressed to the 190 ksi yield strength, but did not fail when stressed to an overaged yield strength of 135 ksi. A new NiCoCrMo age hardenable alloy heat treated to 220 ksi yield strength and stressed to this value did not fail in either environment at temperatures up to 420 F. Also, this material was substantially brighter after the tests than either the K-Monel or A286. ERA

DATA SUMMARY: No numeric data are presented.

N77-17217# California Univ., Livermore. Lawrence Livermore Lab.
STATIC, DYNAMIC TOUGHNESS, AND HIGH STRAIN RATE PROPERTIES OF MARAGING 250, HY-180, AND HP-9-4-20 STEELS
M. E. Prado and C. A. Cordill 11 Feb. 1976 69 p refs
(Contract W-7405-eng-48)
(UCRL-52017) Avail: NTIS HC A04/MF A01

Instrumented impact tests, which provided dynamic properties, indicated a 90 C (194 F) shift in nil ductility temperature for HP-9-4-20. It was also found that the potential exists for evaluating dynamic fracture toughness. Author (ERA)

DATA SUMMARY: Maraging 250, Hy-180, and HP-9-4-20 steels were tested in a temperature range of -195 C to 190 C; variables include fracture toughness, elongation, yield strength, modulus of elasticity, reduction in area, dynamic tear energy, stress intensity, axial strain, axial load, and time; 47 figures and 4 tables include numeric data.

N77-17218# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
CODEPOSITION OF WEAR-RESISTANT PARTICLES WITH CHROMIUM Final Technical Report
John P. Young Mar. 1976 107 p refs
(DA Proj. A12-65508-01-M2-W9)
(AD-A030497; NBSIR-74-615; RIA-RCR-76-029) Avail: NTIS HC A06/MF A01 CSCL 11/3

Inclusion of particles in deposits was achieved by adding any of a number of monovalent cations to the chromium bath such as Tl, Ce, Na, NH and Li. Efforts to include particles from standard chromium baths over a wide range of plating conditions were not successful. Under the plating conditions developed all particles that were added to the bath were included from a few tenths to 5 wt.% in chromium deposit without excessive loss of properties. Particles included were diamond, borides, carbides, nitrides, oxides, metals, graphite, and a sulfide. The more conductive materials were more easily included. A bath-life test using additives and particles was run for thousands of ampere-hours per liter of solution with good bath performance. Wear tests of deposits having included particles indicated improved wear-resistance. A caliber 0.30 tube was plated with chromium having included particles which had good particle distribution throughout the bore. Deposits of cadmium and zinc with included hard particles showed improvement in wear-resistance.
Author (GRA)

DATA SUMMARY: Various specimens were plated with chromium incorporating hard particles and then were heat treated; variables include thallium nitrate concentration, inclusions in chromium-wt%, current density, bath temperature, wear loss, hardness, particle size, and particles in bath-wt%; 25 figures include numeric data.

N77-17219# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTRON MICROSCOPY STUDY OF THE PASSIVATING LAYER IN IRON-NICKEL MARTENSITE M.S. Thesis
Sheree H. Wen Jan. 1976 54 p refs
(Contract W-7405-eng-48)
(LBL-4568) Avail: NTIS HC A04/MF A01

A transmission electron microscopy examined the thin oxide film formed on the surface of Fe-12Ni alloys on exposure to air at room temperature. Using high resolution microscopy, the oxide particles of the film could be directly resolved and their structure and morphology characterized. The following conclusions were drawn from these characterizations studies: (1) A passivating oxide layer (principally Fe3O4) forms spontaneously on the surface of Fe-Ni alloys on exposure to air at room temperature. (2) The orientation relation between the oxide and the metal surface depends on surface orientation; the Bain relation is obeyed when the alloy surface is (100)/sub alpha while the Nishiyama-Wasserman relation is obeyed on other surfaces. (3) The oxide layer consists of dispersed, small oriented particles rather than a continuous thin film. (4) The size of the oxide particles and the density of their distribution are related to the crystal surface orientation and condition. Author (ERA)

DATA SUMMARY: Chemical composition, are presented for Fe, Ni, Cr, Mn, C, N, S, P, and Ti; variables include weight percent, thickness of oxidation layer, time, potential energy, and X ray diffraction data; 2 figures and 6 tables include numeric data.

N77-17220# Federal Highway Administration, Washington, D.C.
TIME-TO-CORROSION OF REINFORCING STEEL IN CONCRETE SLABS. VOLUME 3: PERFORMANCE AFTER 830 DAILY SALT APPLICATIONS Interim Report, Jul. 1971 - Dec. 1975
Kenneth C. Clear Apr. 1976 67 p refs
(PB-258446/4; FHWA-RD-76-70-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 13C

Data are provided on which to base decisions on the type of protection to provide to bridge decks constructed in corrosive environments. Specifically, the objective is to determine the relative time-to-corrosion of reinforcing steel embedded in concrete slabs, fabricated from various mix designs and construction procedures when the slabs are subject to periodic setting with a 3 percent NaCl solution. One hundred and twenty-four, 4 ft. by 5 ft. by 6 in. reinforced concrete slabs were fabricated, cured, and placed in the outdoor exposure yard on elevated stands. Concrete covering the feasible range of mix designs was investigated. Clear concrete cover over the reinforcing steel was varied from 1 to 3 inches.
GRA

DATA SUMMARY: Effect of water cement ratio, as well as various structures, for chloride profiles; variables include cement factor, cement content, chloride content, depth, maximum chloride, and daily salt applications; 14 figures and 4 tables include numeric data.

N77-17221# Army Inst. of Dental Research, Washington, D. C.
APPARENT CYTOTOXICITY OF BASE METAL CASTING

ALLOYS Report for 4 Arp. 1975 - 29 Jul. 1976
Ronald D. Woody, Eugene F. Huget, and John E. Horton 29 Jul. 1976 18 p refs
(AD-A028069; OG-6023) Avail: NTIS HC A02/MF A01 CSCL 06/20

The cytotoxic potentials of three Ni-Cr based alloys (Ticonium 100, Gemini II and Victory) and an Fe-Cr based alloy (Dentillium CB) were assessed. In tissue culture, castings of all four test materials and powders of Dentillium CB did not elicit adverse cellular changes. However, cultures containing Ni-Cr powders showed prominent zones of lysis and cell alteration. Responses to Victory were more severe than those to Ticonium 100 and Gemini II. The cytotoxic potential of products obtained from the surfaces of casting alloys may offer an expedient means for estimation of long term clinical toxicity. Author (GRA)

DATA SUMMARY: Cytotoxic responses (zones of lysis) are presented in three test mediums (fibroblasts, hela cells, and agar overlaid fibroblasts); variables include materials, medium, and time; 1 table includes numeric data.

N77-17222# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
PRODUCING SYNTHETIC RUTILE FROM ILMENITE BY PYROMETALLURGY. PILOT-PLANT STUDIES AND ECONOMIC EVALUATION Report of Investigations 1976
G. W. Elger, D. E. Kirby, and S. C. Rhoads Jul. 1976 38 p refs
(PB-258387/0; BM-RI-8140) Avail: NTIS HC A03/MF A01 CSCL 11F

Pilot plant studies and an economic evaluation of a process developed to produce synthetic rutile from a rock-type ilmenite concentrate are described. In this process, ilmenite blended with coke and lime is smelted in an electric arc furnace to separate most of the iron as salable pig iron and to form a titania enriched slag of low iron content which is treated with oxygen and titanium pyrophosphate. The titanium oxides are converted to crystalline rutile, and the phosphate glass contains most of the associated impurities. The treated slag is ground and leached with sulfuric acid to liberate rutile crystals, which are concentrated by physical methods. In pilot testing conducted to obtain data for a cost estimation, a synthesized product containing about 88 wt-pct TiO2 and less than 2 pct FeO was extracted from a rock-type ilmenite concentrate containing about 45 wt-pct TiO2. The estimated fixed capital cost (on a mid-1975 basis) of a plant producing 500 tpd of synthetic rutile is $28,290,100. Based on 330 operating days per year, the estimated operating cost for this process is $351 per ton of synthetic rutile. GRA

DATA SUMMARY: Chemical analyses of materials used in a plant to produce synthetic rutile and economic analyses of plant operation; variables include weight percent, estimated costs, estimated selling price, pig iron credit, raw material requirements, utility requirements, labor requirements; 1 figure and 15 tables include numeric data.

N77-17223# Babcock and Wilcox Co., Alliance, Ohio. Research Center.
DETERMINING FRACTURE PROPERTIES OF REACTOR VESSEL FORGING MATERIALS, WELDMENTS, AND BOLTING MATERIALS Final Report
W. A. VanDerSluys, R. R. Seeley, and J. E. Schwabe Jul. 1976 73 p refs
(EPRI Proj. 232-3)
(PB-257563/7; EPRI-NP-122) Avail: NTIS HC A04/MF A01 CSCL 11F

A large testing program was initiated to evaluate heat-to-heat variability in fracture toughness of ferritic nuclear pressure vessel steels which are described by the reference toughness curve (KIR) relationship. GRA

DATA SUMMARY: Welding conditions and the results of tensile, drop weight, Charpy impact, and fracture toughness tests; variables include heat input, fracture toughness, thickness, crack growth, Charpy upper shelf energy, Charpy transition impact energy, loading rate, temperature; 43 figures and 7 tables include numeric data.

N77-17224# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
FURTHER DEVELOPMENT AND APPLICATION OF THE LITHIUM NUCLEAR MICROPROBE FOR HYDROGEN ANALYSIS Final Report, 1 Mar. 1974 - 1 Jun. 1975
Gerald M. Padawer, Philip N. Adler, and Michael C. Stauber Aug. 1976 72 p refs
(Contracts N00019-74-C-0176; N00019-72-C-0404)
(AD-A030500; RE-527) Avail: NTIS HC A04/MF A01

Experimental studies have demonstrated the unique capability of the Lithium Nuclear Microprobe for Hydrogen (LNMH) technique for the study of hydrogen-related mechanical property degradation and failure in metallic structural components, particularly those used in aerospace applications. This work has been a logical continuation of earlier studies, partially supported by NASC Contract N00019-72-C-0404, through which the LNMH was established as a reliable technique for accurate in situ measurement of localized hydrogen concentrations in material surface regions. Highlights of the present study include analyses of the effect of interfering background on hydrogen measurement sensitivities in different metals and alloys,. development of techniques for areal mapping of hydrogen distributions, and probing to greater depths than previously achieved. The LNMH technique was also employed in the study of specific materials problems. Hydrogen concentrations were measured in the surfaces of copper-plated D6AC steel samples to evaluate the levels of hydrogen introduced during the various processing stages in the heat treatment of high strength steels. Especially significant among the applications has been the surface analysis of hydrogen as related to failure diagnostics of aircraft parts. This latter work has included the measurements of localized hydrogen in test fracture regions of nose landing gear axle socket assemblies (Aerospace Materials Specification (AMS) 6407 steel) and in fracture regions of service-failed and test-failed jet engine fan blades (Ti-8Al-1Mo-1V). A number of analysis problems not previously encountered were found. GRA

DATA SUMMARY: Localized hydrogen measurements in material surfaces and hydrogen concentration depth profiling; variables include hydrogen concentration, depth, energy, lateral displacement, relative yield, gamma-ray yield, and heat treatment; 8 figures and 7 tables include numeric data.

N77-17225# Construction Engineering Research Lab. (Army), Champaign, Ill.
ALIGNED FERROUS MARTENSITE Interim Report
Khobaid Mohammad Sep. 1976 21 p refs
(DA Proj. 4A1-61102-AT-23)
(AD-A030314; CERL-IR-M-190) Avail: NTIS HC A02/MF A01 CSCL 11/6

Previous research has shown that an Fe-Ni-Mn alloy may be suitable for producing aligned martensite. This work is concerned with the texture and transformation characteristics of the Fe-20%Ni-5%Mn alloy. The austenitic deformation texture was found to be typical face-centered cubic (fcc) texture--(123) (412) rather than (100) (011) as thought previously. Subsequent annealing at 1000 C for 30 min produced a strong annealing cube texture (011) (100). A partial alignment of martensite was obtained by stress-assisted transformation. Nearly 75 percent martensite was aligned when a strongly cube-textured specimen was strained 3 percent at 45 deg to the rolling direction, followed by a liquid nitrogen quench of 10 hours. Author (GRA)

DATA SUMMARY: Stress-strain curve of an untextured specimen of Fe-20.5%Ni-5.5%Mn; variables include chemical composition, stress, and strain; 1 figure and 1 table include numeric data.

N77-17226# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE MEASUREMENT OF WEAR FROM STEEL USING THE RADIOISOTOPE 56CO Final Report
Stephen E. Caldwell and Andrus Niiler Sep. 1976 22 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A030262; BRL-1923) Avail: NTIS HC A02/MF A01

A technique, based on producing a well-defined layer of the radioisotope 56Co in a steel surface, has been developed for measuring wear loss from steel surfaces. In order to achieve

localized wear measurements, in situ, to better than 0.25 micrometer accuracies, the depth profile for producing the 56Co isotope in an iron matrix has been measured to a relative accuracy of 3%. A gun steel sample has been exposed to burning propellant environments in an experimental gun chamber, and the loss of steel from its surface has been monitored for three shots. Using this technique, it is expected that the absolute erosivity of a given propellant/gun-barrel system may be evaluated on the basis of only a few shots, leading to a substantial savings in time and resources. GRA

DATA SUMMARY: A stack of thin iron foils was irradiated with a proton beam and specific activity of each foil was measured; variables include depth, integral yield, gamma-ray yield, time, and wear loss; 3 figures and 3 tables include numeric data.

N77-17227# Avco Lycoming Div., Stratford, Conn.
EVALUATION OF ISOTHERMAL FORGINGS FOR T53 IMPELLERS Final Technical Report, 16 Jun. - 16 Dec. 1976
Elizabeth K. Knauf and Louis J. Fiedler Watertown, Mass AMMRC 16 Dec. 1975 51 p refs
(Contract DAAG46-75-C-0078)
(AD-A030469; USAAVSCOM-R-76-21; AMMRC-CTR-76-14) Avail: NTIS HC A04/MF A01 CSCL 21/5

The primary objective of this program was to evaluate isothermal forgings of Ti-6Al-4V alloy in the form of near-net shaped T53 impellers and determine their potential technical and economic advantages over conventional forgings. An evaluation of mechanical properties showed the isothermal forging properties to meet current forging specifications. Finish machining of one forging was conducted using the current production process. This revealed a time saving of 2.1 standard hours over the conventional forging, a savings primarily in rough machining. Partially formed vanes are not realized as an advantage by the current milling process due to the cam controlled action of the cutter in the existing machining facility, i.e. several Gorton milling machines. A cost analysis of alternative vane milling methods, i.e. numerical and/or adaptive control, has led to the conclusion that a process modification would not be cost effective due to current high efficiency of the Gorton mill. It is therefore recommended that a partial vane contour be included in the forged shape only to the extent that is effective in reducing input material cost without increasing forging costs.
Author (GRA)

DATA SUMMARY: Cost effectiveness and mechanical properties of isothermal machined titanium alloy vanes; variables include cyclic loads, chemical composition, stress/strain diagrams, temperature effects, tensile strength, yield strength, elongation, area reduction, notch strength, strain range, and dimensional stability; 3 figures and 5 tables include numeric data.

N77-17228# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
EFFECTS OF ELECTROLESS NICKEL PROCESS VARIABLES ON QUALITY REQUIREMENTS Final Report
Fielding Ogburn and Christian E. Johnson Jun. 1976 66 p refs
(DA Proj. A12-65509-01-M2-M9)
(AD-A030499; NBSIR-75-720; RIA-R-CR-76-032) Avail: NTIS HC A04/MF A01 CSCL 11/3

The project objective was to determine the effects of production procedures on the characteristics of electroless nickel coatings. Deposition rate, phosphorus content, hardness, appearance, and metal distribution are reported for deposits from several hypophosphite type electroless nickel baths, both proprietary and non-proprietary. The baths were operated under a variety of conditions with variations of composition. Extensive data are given on the relation of deposit hardness to phosphorus content and to heat treatment at 100, 200, and 400 C. Some data are given relative to electroless Ni-B, Ni-P-Cu, and Ni-P-Mn alloys. Author (GRA)

DATA SUMMARY: Hardness measurements were made on Ni-P alloys as plated and after heat treatment; variables include hardness, duration of heat treatment, temperature of heat treatment, pretreatment, deposition time, deposition rate, deposition composition %P, wear, weight loss, and thickness loss; 6 figures and 11 tables include numeric data.

N77-17229# Naval Research Lab., Washington, D.C.
EFFECT OF SECTION SIZE ON THE FATIGUE CRACK GROWTH RATE OF A516-60 Final Report
A. M. Sullivan and T. W. Crooker 4 Aug. 1976 18 p refs
(RR0220146; NRL Proj. M01-24)
(AD-A029427; NRL-8004) Avail: NTIS HC A02/MF A01 CSCL 11/6

Studies of the fatigue crack growth rate of A516-60 pressure-vessel steel indicate no section-size effect in stress-relieved specimens ranging in thickness from 6.35-50.8 mm (0.25 to 2.0 in.). A regression curve equation for all thicknesses, relating cyclic crack growth rate (da/dN) to crack-tip stress-intensity factor range (delta K) is obtained. The significance of these results is discussed in the light of current engineering practice and of previous studies of size effects in fatigue crack propagation. Author (GRA)

DATA SUMMARY: Steel specimen thickness and size effects on crack length; variables include thickness/size correlation coefficient, cyclic load, stress intensity factor range, ductile striation, yield strength, crack length, crack growth rate, and tension stress range; 7 figures and 5 tables include numeric data.

N77-17230# Naval Research Lab., Washington, D.C. Strength of Metals Branch.
INHERENT CORROSION RESISTANCE AND RESPONSE TO CATHODIC PROTECTION IN SEAWATER OF RECENTLY DEVELOPED STAINLESS STEEL ALLOYS Final Report
T. J. Lennox, Jr. and M. H. Peterson 4 Aug. 1976 24 p refs
(PR0220844; NRL Proj. M04-02)
(AD-A029436; NRL-8016) Avail: NTIS HC A02/MF A01 CSCL 11/6

Stainless steel alloys (24Ni-20Cr-6.5Mo, 26Cr-1MO, 22Cr-13Ni-5Mn, and Type 216 stainless steel) were studied for inherent corrosion resistance in quiescent and slowly moving seawater. The response of these alloys to two levels of cathodic protection (mild steel and zinc anodes) was also studied. None of the alloys was completely resistant to corrosion. Most were quite susceptible to crevice corrosion, but two unprotected specimens of 24Ni-20Cr-6.5Mo stainless steel had excellent resistance in both exposure conditions. These specimens exhibited relatively noble freely corroding electrochemical potentials over an extended period. Cathodic protection with either mild steel (Fe) or zinc (Zn) anodes prevented crevice corrosion, but the 26Cr-1Mo and 22Cr-13Ni-5Mn stainless steels showed some edge corrosion and corrosion under the mild steel anode, respectively, when polarized to the potential of mild steel. Author (GRA)

DATA SUMMARY: Corrosion behavior and other characteristics of stainless steels with and without cathodic protection; variables include composition (%), thickness, temperature, resistivity, pH, oxygen content, maximum depth of crevice corrosion, weight loss, time, electric potential; 3 figures and 3 tables include numeric data.

N77-17231# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
KINETICS OF THE MARTENSITE TRANSFORMATION IN ATHERMAL Fe-C-Ni-Cr ALLOYS
R. Pradhan and G. S. Ansell Jul. 1976 45 p refs
(Contract N00014-76-C-0458; NR Proj. 031-689)
(AD-A029374; TR-7) Avail: NTIS HC A03/MF A01 CSCL 11/6

An investigation was conducted to study the martensite transformation kinetics of athermal Fe-C-Ni-Cr alloys. The transformation rate was found to be dependent on alloy composition and was a function of (1) the rate of change of chemical free energy with temperature, and (2) the energy expended in deforming the austenite surrounding a growing martensite embryo in order to accommodate the transformational volume and shear strains. Increasing either of these two factors leads to an increase in transformation rate. Also, it was found that the magnitude of the contribution of the deformation energy to the overall nonchemical free energy associated with the

transformation depends on the alloy system and specific composition. Author (GRA)

DATA SUMMARY: Typical search coil and specimen temperature output are shown; variables include outputs, time, percent martensite, temperature, transformation rate, offset true yield stress, work hardening coefficient, and free energy; 13 figures include numeric data.

N77-17232# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.

HIGH TOUGHNESS TITANIUM ALLOY DEVELOPMENT Final Engineering Report, Jan. 1975 - May 1976

R. G. Berryman, J. C. Chesnutt, F. H. Froes (Colt Industries, Inc., New York), and C. G. Rhodes Jun. 1976 51 p refs

(Contract N00019-75-C-0208)

(AD-A030274; TFD-76-471) Avail: NTIS HC A04/MF A01 CSCL 11/6

This is the final engineering report for a Naval Air Systems Command sponsored program to evaluate the forgeability characteristics of CORONA-5, a new titanium alloy with a nominal composition of Ti-4.5Al-5Mo-1.5Cr. The goal of this contract was to define forging and final heat treat parameters which would produce optimum or near-optimum toughness over the strength range of 130-140 ksi (about 900-965 MPa), UTS. During this program, a total of six different forging sequences were evaluated to identify effects of varying degrees of alpha/beta working on resultant microstructures and attendant mechanical properties. In addition, two different final heat treat cycles were employed to provide strength variations over the goal range. The results of these evaluations indicated that the best combinations of strength and toughness were produced by forging the material above its beta transus or at temperatures high in the alpha plus beta region. GRA

DATA SUMMARY: Results of chemical analysis and beta transus determinations on corona-5 ingot are reviewed; variables include condition, preheat and blocker processing, preheat and finish processing, anneal and age, ingot location, and fracture toughness; 1 figure and 3 tables include numeric data.

N77-17233# TRW, Inc., Cleveland, Ohio.

METAL MATRIX COMPOSITES FOR HIGH TEMPERATURE TURBINE BLADES Final Report

William D. Brentnall Warminster, Pa. NADC Apr. 1976 45 p refs

(Contract N62269-75-C-0119)

(AD-A030074; TRW-ER-7790F; NADC-76225-30) Avail: NTIS HC A03/MF A01 CSCL 21/5

The continued development and evaluation of the refractory wire reinforced FeCrAlY composites designed for application in advanced gas turbine engines are described. These investigations included determination of 1,000-hour creep and stress rupture properties in the temperature range 1037-1148 C, generation of fiber/matrix reaction rate data, tensile tests on angle plied composites, burner rig tests and blade-oriented fabrication studies. Long term stress rupture and creep properties were in agreement with predictions based on earlier shorter time tests. Density compensated strengths of about 2.5:1 over current D.S. eutectics were demonstrated and relatively low creep rates observed. Parabolic growth rates for fiber/matrix reaction zones were identified and reaction rate constants determined. Tensile strengths at 648 and 760 C on angle plied composites indicated adequate strengths for a + or - 15 deg construction in terms of turbine blade root stresses. Preliminary burner rig tests indicated no significant problems for W/FeCrAlY composites exposed to this type of environment. Some blade oriented fabrication studies were also performed. Author (GRA)

DATA SUMMARY: Creep and stress rupture properties, oxidation/compatibility, and tensile strength were determined for fiber reinforced FeCrAlY alloy matrix composites; variables include temperature, applied stress, time to rupture, reduction in area, elongation, tensile strength, creep strain, loading time, exposure time, reaction zone thickness; 7 figures and 3 tables include numeric data.

N77-17234# United Technologies Research Center, East Hartford, Conn.

DETERMINATION OF LONG TERM COMPATIBILITY OF HYDRAZINE WITH SELECTED MATERIALS OF CONSTRUCTION. DESIGN CRITERIA AND GUIDANCE Report for 14 Jun. 1974 - 15 May 1976

C. T. Brown Edwards AFB, Calif. AFRPL Jun. 1976 68 p refs

(Contract F04611-74-C-0041; AF Proj. 3058)

(AD-A030320; AFRPL-TR-76-33) Avail: NTIS HC A04/MF A01 CSCL 21/9

An electrochemical accelerated compatibility test method is described. This description includes the theory of the test method, the equipment required to perform the tests and the method for the preparation of the test specimens. A complete step by step experimental procedure is outlined which includes the range of values used for experimental variables such as scan rate, voltage scale, electrolysis current and relaxation time. The determination of metal dissolution and its relationship to hydrazine decomposition rates is discussed. The results of a series of tests incorporating variables such as metal, metal pretreatment, hydrazine impurities, temperature and time are presented. A statistical analysis of the results using a Graeco-Latin cube design is included which evaluates the relative effect of each of the variables on the value of the equilibrium decomposition current (isubo). Recommendations for material selection and cleaning and passivation techniques are presented in the light of the experimental results. Author (GRA)

DATA SUMMARY: Accelerated life tests were performed to determine hydrazine decomposition on Ti6A14V, 304L SS, AA100, AA6061-Ti6, and AM355; variables include log of current, applied voltage, corrosion current density, time, decomposition rate, impurities, metal pretreatment, # of Coulombs, fraction of Coulombs resulting in metal dissolution, and temperature; 5 figures and 9 tables include numeric data.

N77-17297# Osaka Univ. (Japan). Dept. of Welding Engineering.

KNIFE LINE ATTACK PHENOMENON IN STABILIZED STAINLESS STEELS: MECHANISM OF KNIFE LINE ATTACK PHENOMENON 2

Hiroshi Ikawa, Shigeo Shin, Yoshikuni Nakao, and Kazutoshi Nishimoto *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 427-436 refs (For primary document see N77-17291 08-31)

(Rept-1315) Avail: NTIS HC A10/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-17235 Virginia Univ., Charlottesville.

A STUDY OF THE EFFECT OF PRESSURE ON THE THERMAL CONDUCTIVITY OF LINEAR POLYMERS Ph.D. Thesis

Randall Scott Frost 1976 114 p

Avail: Univ. Microfilms Order No. 77-200

The effect of pressure on the conductivity of the vitreous poly(alkyl methacrylates) is examined. Among the topics considered is the influence of pressure on transition temperatures observed by thermal conductivity measurements. A macroscopic model for the effect of pressure on the conductivity is developed by considering the pressure dependence of the density, the sound velocity and the relaxation time. Finally a microscopic theory to explain the pressure dependence of electron-phonon scattering is presented, and its applicability to linear polymers is demonstrated. Dissert. Abstr.

DATA SUMMARY: Data summary not prepared due to nonavailability of complete document for processing.

N77-17236 Northwestern Univ., Evanston, Ill.

EFFECT OF FLOW ON CRYSTALLIZATION IN POLYMER

MELTS Ph.D. Thesis
Paul George Andersen 1976 131 p
Avail: NTIS Avail: Univ. Microfilms Order No. 77-1196

Ribbons of molten polypropylene have been extruded into a thermostated chamber and subjected to elongations ranging as high as 4,400-fold. Some of these ribbons have been shown to possess the unusual ability of recovering nearly all strain from large levels of stretch (< 100 percent). This property, as well as magnitude of tensile yield drop, has been found to be directly proportional to the uniaxial character of the flow present at the moment of crystallization. Determination of structure in the final solid films has been characterized with wide angle X-ray diffraction and crystal orientation distribution. Both of these have been found to be proportional to character of flow at the moment of crystallization. Finally, the temperature in the thermostated chamber has been shown to affect the character of the flow. Dissert. Abstr.

DATA SUMMARY: Data summary not prepared due to nonavailability of complete document for processing.

N77-17237 Florida Univ., Gainesville.
THE CONVERGING FLOW OF DILUTE POLYMER SOLUTIONS Ph.D. Thesis
Chander Balakrishnan 1976 221 p
Avail: Univ. Microfilms Order No. 77-1102

The flow in the conical region is predominantly extensional in nature. In this work, flow behavior of very dilute polymer solutions was studied in such a geometry. Extensional viscosities were calculated from measurements of the pressure drop across the contraction and photographs of the angle defining the extent of the conical region. The dependence of extensional viscosity on molecular variables such as molecular weight, molecular weight distribution and polymer conformation was examined. The experimentally determined extensional stresses were compared with predictions of the equations of motion, and constitutive theories of dilute polymer solutions. It was shown that previously measured values of extensional viscosities using the thrust technique were conservative due to the underestimation of tensile stresses by an amount equal to the entrance pressure drop. Dissert. Abstr.

DATA SUMMARY: Data summary not prepared due to nonavailability of complete document for processing.

N77-17238*# University of South Florida, Tampa. Dept. of Electrical and Electronic Systems.
ELECTRICAL PROPERTIES OF EPOXIES USED IN HYBRID MICROELECTRONICS Final Report
Cree W. Stout Aug. 1976 181 p refs
(Contract NAS8-31172)
(NASA-CR-150161) Avail: NTIS HC A09/MF A01 CSCL 11A

The electrical properties and basic characteristics of the structure of conductive epoxies were studied. The results of the experimental work performed to measure the electrical properties of epoxies are presented. Author

DATA SUMMARY: Effects of epoxy composition on chemical, thermal, mechanical and electrical properties; the variables are polymeric structure, curing time, water absorption, weight (mass), thermal expansion, temperature effects, fillers, volume shrinkage, tensile strength, compressive yield strength, dielectric strength, dielectric constant, dissipation factor, electrical resistance, aging effects, resistivity versus frequency, and volume resistivity (ohm-cm); 51 figures and 47 tables include numeric data.

N77-17239*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL BARRIER COATINGS: A NEAR TERM, HIGH PAYOFF TECHNOLOGY
S. R. Levine and J. S. Clark 1977 15 p refs Presented at the Workshop on Ceramics for Energy Conversion Systems, Orlando, Fla., 24-26 Jan. 1977; sponsored by ERDA Prepared in cooperation with US Army Air Mobility R and D Lab., Cleveland
(NASA-TM-X-73586; E-9049) Avail: NTIS HC A02/MF A01 CSCL 11B

The present status of thermal barrier coatings is reviewed including both experimental results and forecasts of the benefits derived from use of these coatings in aircraft and utility gas turbines. The potential of thermal barrier coatings relative to structural ceramics is discussed along with a development plan for these coatings. Author

DATA SUMMARY: Performance of various oxide ceramic thermal barrier layers; variables include cycles to failure, leading-edge wall temperature, coolant-to-gas flow ratio, time, weight change, thermodynamic efficiency, and specific output; 4 figures and 1 table include numeric.

N77-17240*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
OPPORTUNITIES FOR CERAMICS IN THE ERDA/NASA CONTINUOUS COMBUSTION PROPULSION SYSTEMS PROGRAM
Charles P. Blankenship and Robert B. Schulz (ERDA, Washington, D.C.) 1977 6 p refs Presented at the Workshop on Ceramics for Energy Conversion Systems, Orlando, Fla., 24-27 Jan. 1977; sponsored by ERDA
(NASA-TM-X-73597; E-9071) Avail: NTIS HC A02/MF A01 CSCL 11B

An overview on engine development projects for potential use of ceramics is reported. A major ceramics materials technology effort is described to meet anticipated engine system requirements in terms of the automotive application, some of the more pressing technology needs, and some indications of how to conduct this technology program with industry-engine development projects focus on both gas turbine and Stirling engines. Author

DATA SUMMARY: No numeric data are presented.

N77-17241*# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
INVESTIGATION OF ORGANIC ADHESIVES FOR HYBRID MICROCIRCUITS Final Report
K. L. Perkins and J. J. Licari Marshall Space Flight Center, Huntsville, Ala. NASA Jul. 1975 134 p
(Contract NAS8-26384)
(NASA-CR-150160; C75-647/201) Avail: NTIS HC A07/MF A01 CSCL 11A

The properties of organic adhesives were investigated to acquire information for a guideline document regarding the selection of adhesives for use in high reliability hybrid microcircuits. Specifically, investigations were made of (1) alternate methods for determining the outgassing of cured adhesives, (2) effects of long term aging at 150 C on the electrical properties of conductive adhesives, (3) effects of shelf life age on adhesive characteristics, (4) bond strengths of electrically conductive adhesives on thick film gold metallization, (5) a copper filled adhesive, (6) effects of products outgassed from cured adhesives on device electrical parameters, (7) metal migration from electrically conductive adhesives, and (8) ionic content of electrically insulative adhesives. The tests performed during these investigations are described, and the results obtained are discussed. Author

DATA SUMMARY: Diverse data are presented; variables include weight loss, time, resistance, bond strength, shear force, temperature, effective gate voltage change, resistance change, weight, current.

N77-17242# Lockheed Missiles and Space Co., Palo Alto, Calif.
LINEAR THEORY OF VISCOELASTICITY
P. M. Ogibalov, V. A. Lomakhin, and B. P. Kishkin [1976] 12 p refs Transl. into ENGLISH from the book "Mekhanika Polimerov" Moscow Univ. Press, 1975 p 117-131
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A linear mathematical formulation for the mechanical properties of stiff polymers is extended to viscoelastic properties by including the presence of a temperature field so that the creep strains are functions of time and depend on the temperature as a parameter. This temperature/time analogy provides a solution for the strain analysis of viscoelastic bodies at variable temperatures. G.G.

DATA SUMMARY: No numeric data are presented.

N77-17243# Lockheed Missiles and Space Co., Palo Alto, Calif.
PREDICTION OF THE CREEP OF POLYMER MATERIALS UNDER RANDOM LOAD-CHANGE PROCESSES AND TEMPERATURE-MOISTURE CONDITIONS OF THE ENVIRONMENT. 2: RANDOM NONSTATIONARY TEMPERATURE-MOISTURE FACTORS
G. A. Andrikson, Z. V. Kalnroze, and Iu. S. Urzhumtsev [1976] 6 p refs Transl. into ENGLISH from Mekhan. Polimerov (USSR) no. 4, 1976 p 616-621
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

An exponential smoothing method is proposed for estimating the statistical moments of nonstationary random processes of environmental temperature changes. It is also shown that the theory of nonstationary random processes can be used to predict the creep of polymer materials for a nonstationary random change in the material temperature and moistness. The method was verified by an investigation of the creep strength of a polyester resin under simple shear and Riga climate conditions. D.M.L.

DATA SUMMARY: Statistical analyses of the behavior of polymers under changing temperature and moisture conditions; variables include statistical moments, time, relaxation, creep; 3 figures include numeric data.

N77-17244# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF THE TEMPERATURE AND MOISTURE ON THE CREEP OF POLYMERS. 3: SHEAR AND SIMULTANEOUS SHEAR WITH TENSION
R. D. Maksimov, V. P. Mochalov, and E. A. Sokolov [1976] 7 p refs Transl. into ENGLISH from Mekh. Polim. (USSR), no. 4, 1976 p 627-632
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

It is shown that the bias function of the relaxation spectrum which expresses the conservation of the temperature-moisture-time analogy is independent stress state in the linear viscoelastic domain for a Poisson ratio close to 0.5. Author

DATA SUMMARY: Pliability curves are presented along with unnormalized integral distribution functions of the relaxation spectra; variables include shear creep, shear, tension, material moisture, creep strain, and stress intensities; 5 figures include numeric data.

N77-17245*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREPARATION OF DIELECTRIC COATINGS OF VARIABLE DIELECTRIC CONSTANT BY PLASMA POLYMERIZATION
Patent Application
Martin Hudis (Allis-Chalmers Mfg. Co., Milwaukee, Wis.) and Theordore Wydeven, inventors (to NASA) Filed 11 Feb. 1977 19 p
(NASA-Case-ARC-10892-2; US-Patent-Appl-SN-767912) Avail: NTIS HC A02/MF A01 CSCL 11C

A plasma polymerization process for the deposition of a dielectric polymer coating on a substrate is reported that reached the substrate in a closed reactor between two temperature controlled electrodes connected to a power supply. The vacuum within the closed reactor caused a monomer gas or a gas mixture of a monomer and diluent to flow into the reactor, generating a plasma between the electrodes. The dielectric constant of the polymer coating being deposited is controlled by regulating gas total and partial pressures, electric field strength and frequency, and current density. A monomer, such as a polar saturated or unsaturated nitrogen-containing compound, or a monomer and diluent, such as a saturated or unsaturated aliphatic hydrocarbon and nitrogen, is thus polymerized to form a dielectric coating of varying dielectric constant. NASA

DATA SUMMARY: Substrate coating by organic dielectric film using controlled gas plasma; the variables are gas pressure, gas temperature, current density, dielectric constant, electric field frequency, and partial gas pressure; no figures and 2 tables are included.

N77-17246# Battelle Columbus Labs., Ohio.
ANALYSIS OF CERAMIC MATERIALS FOR IMPACT MEMBERS IN ISOTOPIC HEAT SOURCES
F. A. Simonen and W. H. Duckworth 14 May 1976 46 p refs
(Contract W-7405-eng-92)
(BMI-X-670) Avail: NTIS HC A03/MF A01

Of the ceramics studied, silicon nitride offers the most promise followed by silicon carbide and aluminum oxide. Stress analyses show severe limitations on allowable velocities for impact with granite following reentry for these ceramics. Impact velocities in the 100 to 200 fps regime can be achieved only by the addition of a layer to distribute the high contact stress. Besides impact limitations, application of ceramic materials in heat sources would present problems both in terms of weight and fabrication. The required thickness of a ceramic impact member would be comparable to that for a carbon-carbon composite material, but the least dense of the high strength ceramics are 2 to 3 times more dense than the carbon-carbon composites. Fabrication of a ceramic heat source would require a high strength bond between the fuel and the impact member to achieve reasonable impact velocities. ERA

DATA SUMMARY: Performance of ceramic materials considered for use as impact protection for isotopic heat sources; variables include density, modulus, tensile strength, impact velocity, stress, time, displacement, probability of fracture; 13 figures and 1 table include numeric data.

N77-17247# General Electric Co., St. Petersburg, Fla. Dept. of Neutron Devices.
SHEAR MODULUS TESTING OF POLYESTER ELASTOMERS WITH TORSION PENDULUM
K. E. Creed 22 Mar. 1976 13 p
(Contract E(29-2)-656)
(GEPP-210) Avail: NTIS HC A02/MF A01

The determination of shear modulus was introduced as a test requirement on purchased polyurethane elastomer because this dynamic test was nondestructive, more precise and reflected the material end-use characteristics better than tensile and tear test parameters. Since torsion pendulum equipment was not commercially available, an apparatus was designed and fabricated. Comparison tests with another shear modulus tester showed good agreement of test results. Author (ERA)

DATA SUMMARY: Shear modulus results for different materials and aging conditions; variables include shear modulus, temperature, time; 7 tables include numeric data.

N77-17248# Mound Lab., Miamisburg, Ohio.
BORON-FILLED ELASTOMERS (SANL 252-056)
Robert E. Schneider and Lawrence W. Hartzel 20 Apr. 1976 11 p
(Contract E(33-1)-GEN-53)
(MLM-2315) Avail: NTIS HC A02/MF A01

A series of boron-filled vinyl copolymer elastomer (VCE) and Viton A fluoroelastomer formulations was prepared and the physical characteristics of the cured formulations determined. Their weight loss on heating to 300 C, as determined by two different analytical methods, did not agree. The presence of up to 0.23 percent boric acid in the boron powders used to fill a standard boron-filled VCE elastomer did not appear to affect the physical characteristics of the cured formulation. Author (ERA)

DATA SUMMARY: Characteristics of boron powders and boron filled elastomers; variables include average particle size, density, swell ratio, percent weight loss, hardness, tensile strength, percent solvent extraction, elongation; 7 tables include numeric data.

N77-17249# Sandia Labs., Albuquerque, N.Mex.
AGING CHARACTERISTICS OF ELECTRICALLY CONDUCTIVE ADHESIVES
Nicholas J. DeLollis 1976 25 p refs Presented at the 21st Natl. SAMPE Symp. on Bicentennial of Materials Progress, Los Angeles, 6 Apr. 1976 Sponsored by ERDA
(SAND-75-5902; Conf-760409-1) Avail: NTIS HC A02/MF A01

The variation of resistivity and tensile adhesion bond strength with aging at four different temperatures and three time intervals for four epoxy adhesives with the same resin/curing agent system is described. Three of the adhesives have conductive metallic fillers while the fourth is formulated as a structural nonmetallic filled adhesive. The metallic fillers are gold, silver, and silver/palladium. The gold-filled adhesive showed the least resistance to the aging conditions with the strength falling off rapidly at 150 C. The silver/palladium did somewhat better with a gradual decrease in strength at 150 C while the silver-filled formulation showed the most rapid decrease in strength above 150 C. The nonmetallic filled formulation was considerably stronger than the others with a tensile adhesion strength of greater than 54 MPa. Bond strength decreased only after exposure to 200 C. Resistivity was constant between conductive formulations for practically all exposures. There was some indication that silver migration occurred from the silver-filled epoxy into the gold layer at 150 and at 200 C. ERA

DATA SUMMARY: Effects of aging on epoxy adhesives; variables include exposure temperature, exposure time, tensile adhesion strength, coefficient of variation, electrical resistivity; 5 figures and 4 tables include numeric data.

N77-17250# Bosch (Robert) G.m.b.H., Gerlingen (West Germany).
COATING TESTS ON GRAPHITE VORTEX PLATES Final Report
Kuno Kirner Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1976 56 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-RFT-3770; GfW-RV-11-08/7/70-Z)
(BMFT-FB-W-76-12) Avail: NTIS HC A04/MF A01; ZLDI, Munich, DM 11,35

Graphite plates with bores through which high energy rocket fuel components are mixed by turbulence were coated with high temperature materials by plasma spraying techniques. In the turbulent mixing a more complete reaction should take place. Results of the test show that all metals - except tungsten - and all oxides, carbides, silicides, and nitrides tested melt under the test conditions (T appr. 4,000 to 4,500 K, p appr. 20 kp/sq mm) and then even increase the ablation of the graphite. Coatings of tungsten withstood the extreme conditions without a change of the bore diameter, but almost all tungsten coating failed because of circular cracks. The maximum firing time was approximately 20 sec. As anticipated, durations of 3 min could not be obtained with graphite vortex plates coated by plasma spraying. Author (ESA)

DATA SUMMARY: No numeric data are presented.

N77-17251# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Kunststoffe.
INVESTIGATIONS OF HOLLOW GLASS FIBERS FOR THE DEVELOPMENT OF REINFORCED PLASTICS
Guenter Niederstadt, Michael Gaedke, and Heidemarie Baeuml 16 Aug. 1976 46 p refs In GERMAN; ENGLISH summary
Report will also be announced as translation (ESA-TT-360)
(DLR-FB-76-45) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, DM 23

Theoretical and experimental investigations were carried out to find a hollow fiber suitable for reinforcement purpose. An optimal wall-thickness/diameter ratio was determined theoretically according to the elasticity of the resin matrix. Fiber diameter, wall-thickness, dimensional inhomogeneities and surface conditions as voids and cracks were subject of experimental investigations, including the evaluation of microscopic and electroscan photographs. Strength properties and their scatter was of interest. The ultimate fiber strength was found to be rather low compared with the strength of solid fibers. Author (ESA)

DATA SUMMARY: Theoretical and experimental studies on hollow glass fibers for laminates; variables are resin matrix elasticity, fiber wall thickness/diameter ratio, dimensional inhomogeneity, reinforcing fiber volume, fiber capillarity, fiber strength, and specific fiber weight; 7 figures and 4 tables are included.

N77-17252# Maryland Univ., College Park. Dept. of Textiles and Consumer Economics.
A BASIC INVESTIGATION OF THE EXTINGUISHABILITY OF VARIOUS FABRICS M.S. Thesis. Final Report
Linda Bartlett Miles 1976 96 p refs
(Contract NBS-4-9019)
(PB-257767/4; NBS-GCR-76-77) Avail: NTIS HC A05/MF A01 CSCL 13L

Linear burning rate and heat flux were measured for twelve fabrics within a TRI Flammability Analyzer cabinet. Initial work dealt with ambient oxygen effects on the burning rate and heat flux of each fabric measured at four levels of oxygen. From the resulting data, a series of relationships were studied by regression techniques. The latter work investigated heat sink/intersticial effects on burning rate and heat flux. Heat sink designs were evaluated using temperature and distance as variables. Each fabric was tested at three heat sink distances. GRA

DATA SUMMARY: Sensitivity of 12 fabrics to depletion of oxygen and cooling; variables include oxygen concentration, linear burning rate, heat flux, mass burning rate, heat sink distance, heat sink temperature, fiber composition, color, construction, and weight; 28 figures and 11 tables include numeric data.

N77-17253# Maryland Univ., College Park. Dept. of Textiles and Consumer Economics.
AN INVESTIGATION OF CERTAIN DESIGN PARAMETERS OF THE MUSHROOM APPAREL FLAMMABILITY TESTER Final Report
Anne Kathleen Stratton Jul. 1976 114 p refs
(Contract NBS-4-9019)
(PB-257836/7; NBS-GCR-76-78) Avail: NTIS HC A06/MF A01 CSCL 13L

In this instrument, cylindrical specimens of apparel fabrics are suspended from a circular top plate, and the rate of heat transfer to the top plate and a cylinder inside the specimen are measured. The effects of changing the cylinder diameter, and of introducing rods between the specimen and the cylinder to prevent deposition of molten polymer on the cylinder are described. Heat transfer rates measured on the top plate and on the cylinder are compared. Design parameters for the present version of this instrument and the corresponding test method were chosen on the basis of this investigation. GRA

DATA SUMMARY: Composition characteristics and heat transfer rate for 15 fabrics are presented; variables include time, heat transfer rate, estimated total MHTR, probability, 3 inch cylinder values, 5 inch cylinder values, fiber composition, construction, color, weight (oz/sq yd), and record output; 14 figures and 14 tables include numeric data.

N77-17254# Naval Ship Research and Development Center, Bethesda, Md.
DRAG REDUCTION OF DEGRADED AND BLENDED POLYMER SOLUTIONS
T. T. Huang and N. Santelli Dec. 1975 38 p refs
(ZF61412001)
(AD-A028214; DTNSRDC-4311) Avail: NTIS HC A03/MF A01 CSCL 20/4

A 3.18-cm-ID smooth turbulent flow pipe facility was utilized to measure the drag-reduction characteristics of three polymer solutions: Polyox WSR-301, Separan 237, and Magnifloc 835A. A rotating disk was used to degrade the polymer solutions, and accurate control was maintained over the energy used to agitate (shear degrade) them. Quantitative data were obtained on the relationship between degradation and drag reduction for these three polymers and for blended solutions prepared by mixing two different polymers in various proportions. GRA

DATA SUMMARY: Properties of degraded polymer solutions; variables include viscosity, concentration, specific energy dissipation, drag reduction; 8 figures and 2 tables include numeric data.

N77-17255# Naval Civil Engineering Lab., Port Hueneme, Calif.
EXPERIMENTAL POLYURETHANE FOAM ROOFING SYSTEMS Technical Report, Jan. 1973 - Oct. 1975
John R. Keeton, Robert L. Alumbaugh, and Edwin F. Humm

Aug. 1976 119 p
(YF5354007)
(AD-A031046; CEL-TN-1450) Avail: NTIS HC A06/MF A01 CSCL 13/13

An experimental roofing installation is described in which polyurethane foam is spray-applied to metal Butler-type roofs and then coated with five different elastomeric coatings. The coating systems included a catalyzed silicone rubber, a moisture-curing silicone rubber, a hypalon mastic, and two catalyzed butyl-hypalons. Temperatures recorded on top of the foam, on the metal roof deck, and in the building attics, reveal the insulating quality of the foam. Fuel usage before and after application of the foam is included - a natural gas savings of 53% is indicated after foaming. The performance of each of the five coating systems over a 22-month period is summarized. Best overall performance was observed with the silicone rubbers; the poorest performance was with one of the catalyzed butyl-hypalons. Hail damage was observed on all of the coating systems except the silicones. Minor roof repairs that were done within the first year after installation are reported. GRA

DATA SUMMARY: Results of studies regarding the effectiveness of polyurethane foam as an insulative roofing material; variables include temperature, relative humidity, wind speed, thickness, gas consumption, heating monthly degree days, tensile strength; 9 figures and 6 tables include numeric data.

N77-17256# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
EVALUATION OF MESL MEMBRANE-PUNCTURE, STIFFNESS, TEMPERATURE, SOLVENTS
John M. Sayward Jun. 1976 69 p refs
(DA Proj. 4A1-62121-A-894)
(AD-A027834; CRREL-76-22) Avail: NTIS HC A04/MF A01 CSCL 08/13

Several membrane materials used or considered for MESL (membrane-enveloped soil layer) utilization of poor soils in road contruction have been tested for cold effect on puncture and stiffness. PE(polyethylene) film was also tested for solvent soak effects. A simple blunt needle apparatus was devised for puncture testing. For plastic films (mainly PE), both puncture resistance and stiffness increase at low temperature (0 F, -18 C). For non-woven, spunbonded fabrics these properties are little affected by cold. For both non-wovens and PE film, puncture and bending strengths increase linearly with weight or thickness. The slope is steeper for the non-wovens, which generally are stonger on a per unit weight basis. PE film soaked in a hydrocarbon solvent swelled approximately 17% and lost about 30-40% of its puncture strength. These effects are apparently reversible upon drying. Consideration has been given to sealing and patching requirements and to the drying of sealant liquids when adhering film to film. Also considered have been possible slippage related to the reported low angle of friction of plastic films in soil and the possibility of lamination for improved membrane properties. Author (GRA)

DATA SUMMARY: Experimental evaluation of solvent-soaked polyethylene film and of several nonwoven fabrics considered for membrane-enveloped soil layer utilization; variables include temperature, puncture load, bending load, thickness, membrane weight, pretreatment, apparent density, peeling resistance, water loss, and time; 8 figures and 13 tables include numeric data.

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-17257*# Princeton Resources, Inc., N. J.
IGNITION TRANSIENTS OF LARGE SEGMENTED SOLID ROCKET BOOSTERS Final Report
Leonard H. Caveny (Princeton Univ., N. J.) and Kenneth K. Kuo (Penn. State Univ., University Park) Marshall Space Flight Center, Huntsville, Ala. NASA Apr. 1976 110 p refs
(Contract NAS8-31666)
(NASA-CR-150162) Avail: NTIS HC A06/MF A01 CSCL 21I

A model is described which provides a means for analyzing the complexities of ignition transients and pressure peaks of large, high performance, segmented solid rocket boosters. The method accounts for: (1) temporal and spatial development of the flow field set up by the head end igniter discharge, (2) ignition and flame spreading coupled to chamber flow, (3) the steep velocity, pressure, and temperature gradients that occur during the early phases of ignition, and (4) the interactions that produce ignition spikes (i.e., compression of chamber gases during pressurization, erosive burning, and mass added effect of igniter discharge). The technique differs from earlier models in that the flow interactions between the slots and main chamber are accounted for, and the original computer program for monolithic motors is improved. The procedures were used to predict the ignition transients of the current design for the space shuttle booster. Author

N77-17258*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ELECTROEXPLOSIVE DEVICE Patent Application
Vincent J. Menichelli, inventor (to NASA) (JPL) Filed 8 Nov. 1976 19 p
(Contract NAS7-100)
(NASA-Case-NPO-13858-1; NASA-Case-NPO-13859-1; US-Patent-Appl-SN-740153) Avail: NTIS HC A02/MF A01 CSCL 19A

An improved electroexplosive device is described. It consists of a header with contact pins sunk in a heat sink layer, and a bridge circuit placed across the contact pins. Layers of igniter and output charges are placed over the heat sink layer and the bridge circuit. The device provides a great reliability against inadvertent magnetic or electrostatic charge ignition. I.M.

N77-17259*# Northrop Services, Inc., Huntsville, Ala.
DETERMINATION OF BURNING AREA AND PORT VOLUME IN COMPLEX BURNING REGIONS OF A SOLID ROCKET MOTOR
J. A. Kingsbury Feb. 1977 115 p refs
(Contract NAS8-31644)
(NASA-CR-150114; TR-1726) Avail: NTIS HC A06/MF A01

An analysis of the geometry of the burning in both star-cylindrical port interface regions and regions of partially inhibited slots is presented. Some characteristics parameters are defined and illustrated. Methods are proposed for calculating burning areas which functionally depend only on the total distance burned. According to this method, several points are defined where abrupt changes in geometry occur, and these are tracked throughout the burn. Equations are developed for computing port perimeter and port area at pre-established longitudinal positions. Some common formulas and some newly developed formulas are then used to compute burning surface area and port volume. Some specific results are presented for the solid rocket motor committed to the space shuttle project. Author

N77-17260# Los Alamos Scientific Lab., N.Mex.
SOLID PROPELLANT IMPACT TESTS
E. C. Snow Mar. 1976 15 p ref
(Contract W-7405-eng-36)
(LA-6283-MS) Avail: NTIS HC A02/MF A01

The continued use of radioisotopes as heat sources for thermoelectric power generators involves the risk of radioactive contamination of the environment, the effects on such a system of a solid propellant fire environment resulting from a catastrophic launch pad abort are considered. Several impact tests were conducted in which either a simulant MHW-FSA or a steel ball was dropped on the cold, unignited or the hot, burning surface of a block of UTP-3001 solid propellant. The rebound velocities were measured for both surface conditions of the propellant. The resulting coefficient of restitution, determined as the ratio of the components of the impact and rebound velocities perpendicular to the impact surface of the propellant, were not very dependent on whether the surface was cold or hot at the time of impact. ERA

N77-17261# Thiokol Corp., Huntsville, Ala.
AEROHEAT STRUCTURAL TEST VEHICLES. DESIGN, INSTRUMENTATION, MANUFACTURE, AND CALIBRATION
O. R. Pritts Jun. 1976 153 p
(Contract F33615-72-C-0069; AF Proj. 3148)
(AD-A029052; AFRPL-TR-76-42; Rept-76-9) Avail: NTIS HC A08/MF A01 CSCL 21/8

Six aeroheat motors 6-inch I.D. by 24-inch long were designed, instrumented, and manufactured. All six motors were C.P. configurations with the web fractions based on producing a bore strain of 75%, 100% and 125% of the propellant strain endurance when the motors were at -65 F. Three of the motors referred to as AH-1, AH-2, and AH-3 were loaded with TP-H8227 propellant (an 88% total solids, low rate formulation containing 6.6% HMX to web fractions of 0.77, 0.80, and 0.82, respectively). The remaining three motors - AH-4, AH-5, and AH-6 were loaded with TP-H8220 propellant (an 88% total solids high rate formulation) and had web fractions of 0.79, 0.76, and 0.81, respectively. Four motors did fail during gage checkout. Investigating the fact that these failed at strain levels less than strain endurance revealed that each had failed over the thermocouple array which led to the conclusion that the thermocouple itself was the cause of failure. A description of the motor failures, along with a discussion of the motor design, the grain instrumentation, the motor manufacture procedures and instrumentation methods, the test arrangement, data acquisition procedures, data reduction methods, and the test results are presented in the body of this report. GRA

N77-17262# Federal Energy Administration, Washington, D.C. Office of Oil and Gas Analysis.
PETROLEUM SUPPLY AND DEMAND IN THE NONCOMMUNIST WORLD 1973
Patricia O. Busch Aug. 1976 48 p Sponsored by FEA
(PB-256118/1; FEA/B-75/674) Avail: NTIS HC A03/MF A01 CSCL 21D

Petroleum supply and demand statistics for the Noncommunist world are listed by major geographic area. Also included are a map of the international movement of petroleum and statistics on proven reserves of crude oil. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-17263*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONFERENCE ON CHARGE-COUPLED DEVICE TECHNOLOGY AND APPLICATIONS
1976 229 p refs Conf. Proc. held at Washington, D.C., 30 Nov. - 2 Dec. 1976
(Contract NAS7-100)
(NASA-CR-149583; JPL-SP-43-40) Avail: NTIS HC A11/MF A01 CSCL 14B

Papers were presented from the conference on charge coupled device technology and applications. The following topics were investigated: data processing; infrared; devices and testing; electron-in, x-ray, radiation; and applications. The emphasis was on the advances of mutual relevance and potential significance both to industry and NASA's current and future requirements in all fields of imaging, signal processing and memory. For individual titles, see N77-17264 through N77-17290.

N77-17264*# ITT Electro-Physics Labs., Inc., Columbia, Md. Avionics Div.
CCD FILTER AND TRANSFORM TECHNIQUES FOR INTERFERENCE EXCISION c33
G. M. Borsuk and R. N. DeWitt *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 1-20 refs (For primary document see N77-17263 08-31)
(Contract N00014-76-C-0496)
Avail: NTIS HC A11/MF A01 CSCL 09A

The theoretical and some experimental results of a study aimed at applying CCD filter and transform techniques to the problem of interference excision within communications channels were presented. Adaptive noise (interference) suppression was achieved by the modification of received signals such that they were orthogonal to the recently measured noise field. CCD techniques were examined to develop real-time noise excision processing. They were recursive filters, circulating filter banks, transversal filter banks, an optical implementation of the chirp Z transform, and a CCD analog FFT. Author

N77-17265*# Texas Instruments, Inc., Dallas.
A SYNTHETIC APERTURE PROCESSOR USING CCD SIGNAL PROCESSING TECHNIQUES c32
W. H. Bailey, M. S. Bergath, J. F. DuBose, W. L. Eversole, J. H. McGehee, R. V. Ridings, and D. C. Young *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 21-32 refs (For primary document see N77-17263 08-31)
(Contracts JPL-953954; JPL-954087; JPL-954340)
Avail: NTIS HC A11/MF A01 CSCL 17I

Synthetic aperture radar (SAR) imaging was the most suitable technique for achieving high resolution imagery through atmospheric cloud cover. This feature was important for planetary as well as earth orbiting satellite systems, and for military aircraft applications. Such applications require onboard data processing or wide-band data transmission systems in order to handle the large amounts of raw data produced by such systems. A number of techniques were utilized in implementing SAR processors. Frequency filtering and Fourier transform operations using both optical and digital techniques were utilized in SAR processing. Author

N77-17266*# Maryland Univ., College Park.
FOURIER ANALYSIS COMPUTER-AIDED DESIGN OF CCD SIGNAL PROCESSING ANALOG MULTIPLIER ARRAYS c32
H. C. Lin, D. R. Lampe (Westinghouse Electric Corp., Baltimore), M. H. White (Westinghouse Electric Corp., Baltimore), and I. A. Mack (Westinghouse Electric Corp., Baltimore) *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 33-44 refs (For primary document see N77-17263 08-31)
(Contract NAS1-13674)
Avail: NTIS HC A11/MF A01 CSCL 17B

The design of MOS multipliers with CAD was studied. In particular the Fourier analysis capability of the CAD program was used to analyze the harmonic distortion rejection, DR, of the multiplier. Author

N77-17267*# Aerospace Corp., El Segundo, Calif.
METAL-INSULATOR-SEMI-CONDUCTOR STUDIES OF LEAD TELLURIDE c33
D. A. Lilly, D. E. Joslin, and H. K. A. Kan *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 45-48 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 09C

The capacitance and conductance-voltage characteristics were measured on metal-insulator-semiconductor capacitors fabricated with zirconium dioxide films on single-crystal lead telluride. At 77 K, on both n- and p-type substrates, evidence of surface potential control was obtained. Comparison of the measured capacitance-voltage characteristics with those calculated from the equilibrium solution of the one-dimensional Poisson equation indicated qualitative agreement, although the slope of the measured capacitance in the region near the capacitance minimum was less steep than calculated. Author

N77-17268*# Santa Barbara Research Center, Goleta, Calif.
InSb ARRAYS WITH CCD READOUT FOR 1.0- TO 5.5-MICRONS INFRARED APPLICATIONS c32
J. D. Phillips, J. B. Scorso, and R. D. Thom *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 49-56 ref (For primary document see N77-17263 08-31)
(Contracts NAS1-13937; NAS1-14395)
Avail: NTIS HC A11/MF A01 CSCL 14B

There were two approaches for fabricating indium antimonide (InSb) arrays with CCD readout discussed. The hybrid approach integrated InSb detectors and silicon CCDs in a modular assembly via an advanced interconnection technology. In the monolithic approach, the InSb infrared detectors and the CCD readout were integrated on the same InSb chip. Both approaches utilized intrinsic (band-to-band) photodetection with the attendant advantages over

extrinsic detectors. The status of each of these detector readout concepts, with pertinent performance characteristics, was presented. Author

N77-17269*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
COMPUTER-AIDED ANALYSIS OF CCD LINEAR IMAGE SENSORS c60
Steven S. Prince *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 57-62 (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 09B

Special test equipment and techniques to collect and process image information from charge coupled devices (CCDs) by digital computer were reviewed. The video channel was traced from the CCD to the direct memory access bus of the Interdata Computer. Software was developed to evaluate and characterize a CCD for (1) dark signal versus temperature relationship, (2) calculation of temporal noise magnitude and noise shape for each pixel, (3) spatial noise into the video chain due to dark signal, (4) response versus illumination relationship (gamma), (5) response versus wavelength of illumination (spectral), (6) optimization of forcing functions, and (7) evaluation of an image viewed by a CCD. The basic software differences and specific examples of each program operating on real data are presented. Author

N77-17270*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TESTING THINNED, BACKSIDE ILLUMINATED CCD AREA IMAGE SENSORS c35
George Root *In its* Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 63-71 refs (For primary document see N77-17263 08-31)
(Contract NAS7-100)
Avail: NTIS HC A11/MF A01 CSCL 14B

Test techniques were developed making use of computer processing of the video data. The results of testing device noise and nonuniformity were obtained. Read-out noise levels of 25 to 50 electrons rms and uncorrected nonuniformity of response of about 1 to 3% were measured. A simple technique for linearly correcting nonuniformity was described and examples given. The technique was shown to be successful in reducing nonuniformity to the level of random noise. Author

N77-17271*# Martin Marietta Aerospace, Orlando, Fla.
HIGH DATA RATE PERFORMANCE OF A BCCD FOR RAPID SCAN IMAGING c35
David E. Schmieder and Stanley P. Buchanan *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 72-82 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

A commercially available 1728 element shallow bulk channel CCD line array was clocked at output data rates up to 30 MHz. Temporal noise was near 200 electrons and was largely independent of clock rate. Charge transfer efficiency was in excess of 0.9999 at 30 MHz. Utilization is feasible for visual simulation and aerial mapping. Author

N77-17272*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
LOW-NOISE VIDEO AMPLIFIERS FOR IMAGING CCD'S c35
Frank Scinicariello *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 83-88 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

Various techniques were developed which enable the CCD (charge coupled device) imaging array user to obtain optimum performance from the device. A CCD video channel was described, and detector-preamplifier interface requirements were examined. A noise model for the system was discussed at length and laboratory data presented and compared to predicted results. Author

N77-17273*# Rockwell International Corp., Anaheim, Calif. Electronics Res. Div.
A SUB-NANOSECOND CCD c33
Y. T. Chan *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 89-94 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 09C

A 32-cell silicon n-channel PCCD was fabricated and tested for charge transfer efficiency versus transfer time. A charge transfer time of 550 picoseconds with a 0.9998 transfer efficiency was obtained when operated in the uni-phase mode. These conditions correspond to an operating rate of 900 MHz when operated as an analog data or digital device. Author

N77-17274*# ITT Electro-Physics Labs., Inc., Columbia, Md. Avionics Div.
ELECTRON BEAM IRRADIATION OF THINNED BACKSIDE ILLUMINATED CCDS c73
G. M. Borsuk, J. A. Green, R. N. DeWitt, and J. M. Milliany (Naval Res. Lab., Washington, D.C.) *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 95-100 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 20J

The physical properties of backside illuminated surface channel CCD arrays and a pixel buried channel CCD array when bombarded with electrons were studied. The devices were mounted in a high vacuum system and irradiated with electrons generated by an electron gun. Basic measurements of EBS gain, dead voltage, transfer efficiency and dark current were performed to verify proper device operation. The surface channel devices were then irradiated with electrons of up to 8 keV energy for up to 98 hours while the buried channel device was irradiated with electrons. Author

N77-17275*# Electronic Vision Corp., San Diego, Calif.
RECENT PROGRESS IN PHOTOELECTRON IMAGE DETECTION WITH CCDS c35
John P. Choisser *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 101-105 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

Intensified CCDs (ICCDs) were built and operated. These ICCDs were electrostatically and magnetically-focussed image tubes which use CCDs as anodes. The ICCDs detected single photoelectrons, and have electron gain very near that which was predicted. The first single-pixel pulse-height distributions were presented, and the leakage current was shown to increase as a function of photoelectron irradiation. The advantages and disadvantages of front- and rear-illuminated designs were discussed in light of differing applications requirements. Author

N77-17276*# Westinghouse Electric Corp., Baltimore, Md.
X-RAY QUANTUM EFFICIENCIES OF CCD'S c74
Martin Peckerar, W. D. Baker, and D. J. Nagel *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 106-109 refs Sponsored by ONR Prepared in cooperation with NRL, Washington, D. C. (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 20F

The X-ray quantum efficiency of a CCD was still high enough to obtain good X-ray imaging with this device. The range and response of the CCD to incident X-rays in the 5 to 14.1 KeV range were determined experimentally. Knowledge of this range and response allows direct measurement of quantum efficiency. Quantum efficiency decreased monotonically from 82% to 35% in the range studied. Comparison of experimental and theoretical quantum efficiencies allowed a determination of silicon bulk electron diffusion length. For the device studied, the electron diffusion length was 75 micrometers. Author

N77-17277*# Naval Research Lab., Washington, D.C.
EFFECTS OF NEUTRON IRRADIATION ON THE CHARACTERISTICS OF A BURIED CHANNEL CCD AT 80 DEGREES KELVIN AND 295 DEGREES KELVIN c72
N. S. Saks, J. M. Killiany, and W. D. Baker *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 110-114 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 18H

Buried channel CCD shift registers were irradiated with 15 MeV neutrons. The irradiations were performed at 80 K and 295 K on operating devices with normal clocks and bias voltages applied. Dark current increased from the pre-irradiation value of 7 nA/sq cm to 1,600 nA/sq cm at 1 x 10 to the 13th power

n/sq cm. The input gate threshold shift observed at 80K was minus 0.9 volts per 10 to the 13th power n/sq cm, a factor of 4 less than that predicted from a first order calculation of the equivalent ionization dose of neutrons in the oxide. Transfer efficiency measurements yielded a bulk electron trap creation rate for neutron irradiation of 14.0 cm to the minus 1 power at 295 K with a trap emission time constant of 25 microseconds. Author

N77-17278*# California Univ., Livermore. Lawrence Livermore Lab.

A CCD INTEGRATED CIRCUIT FOR TRANSIENT RECORDERS c33

Joseph W. Balch and Charles F. McConaghy *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 115-119 refs (For primary document see N77-17263 08-31)
(Contract W-7405-eng-48)
Avail: NTIS HC A11/MF A01 CSCL 09A

A 50 MHz CCD integrated circuit is described that was developed for use in transient analog signal recorders to sample and time expand transient signals. The integrated circuit achieves an effective 200 MHz sample rate by using four 32 stage peristaltic CCDs to sample the transient signal four times each clock period. Dual frequency, 4 phi clocking is used to sample and time expand the sampled data. The output signals of the four CCDs are multiplexed on chip into a single low frequency output data line. When operated with 50 MHz/165 KHz 4 phi clocks, this circuit has a 200 MHz sample rate, a record length of 640 nanoseconds, a time expansion factor of 303, and overall signal to noise ratio of 40:1. The signal to noise ratio is limited by fixed pattern noise of the four CCDs. Author

N77-17279*# Cincinnati Univ., Ohio. Solid State Electronics Lab.

LINEAR CHARGE COUPLED DEVICE DETECTOR ARRAY FOR IMAGING LIGHT PROPAGATING IN AN INTEGRATED THIN-FILM OPTICAL WAVEGUIDE c74

C. L. Chen and J. T. Boyd *In* JPL Conf. on Charge-Coupled Device Technol. and Appls 1976 p 120-125 refs Prepared for Rockwell Intern. Corp., El Segundo (For primary document see N77-17263 08-31)
(Grant AF-AFOSR-3032-76)
Avail: NTIS HC A11/MF A01 CSCL 20F

Device design, fabrication, and operation of a linear charge coupled device (CCD) detector array integrated with a thin film optical waveguide and applications of this structure to integrated optical signal processing and fiber optical communications were discussed. A two phase, overlapping-gate CCD is connected in parallel by means of a series of gates to an array of photodiodes. The photodiode provides an electrode free surface region so that a highly efficient waveguide detector coupling technique can be implemented. A thermally-oxidized layer of SiO2 forms an effective substrate for the optical waveguide. Author

N77-17280*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

TELEVISION CAMERAS EMPLOYING SOLID-STATE IMAGING SENSORS FOR MANNED SPACECRAFT APPLICATIONS c32

Bernard C. Embrey, Jr. *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 126-128 (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 17B

The Space Shuttle television system incorporates a versatile complement of TV equipment which allows the positioning, quantity, and performance capabilities of the multiple TV cameras to vary as dictated by the particular mission. However, current TV camera technology employing glass enclosed, vacuum processed image sensors results in a bulky device that restricts its location and versatility. Problems and potential solutions that can be achieved through the employment of solid-state image sensors for both monochrome and color applications are discussed. Author

N77-17281*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.

RECON 6: A REAL-TIME, WIDE-ANGLE, SOLID-STATE RECONNAISSANCE CAMERA SYSTEM FOR HIGH-SPEED, LOW-ALTITUDE AIRCRAFT c35

Richard L. Labinger *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 129-134 (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14E

The maturity of self-scanned, solid-state, multielement photosensors makes the realization of 'real time' reconnaissance photography viable and practical. A system built around these sensors which can be constructed to satisfy the requirements of the tactical reconnaissance scenario is described. The concept chosen is the push broom strip camera system -- RECON 6 -- which represents the least complex and most economical approach for an electronic camera capable of providing a high level of performance over a 140 deg wide, continuous swath at altitudes from 200 to 3,000 feet and at minimum loss in resolution at higher altitudes. Author

N77-17282*# Arizona Univ., Tucson. Dept. of Planetary Sciences.

ASTRONOMICAL IMAGING APPLICATIONS FOR CCDS c89

Bradford A. Smith *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 135-138 (For primary document see N77-17263 08-31)
(Grant NGL-03-002-002; Contract JPL-954057)
Avail: NTIS HC A11/MF A01 CSCL 03A

Preliminary testing of a back illuminated, buried channel CCD camera for astronomical telescopic imaging applications was demonstrated. Images of several planets and both galactic and extragalactic ojects were obtained using a 400 x 400 element TI CCD in a JPL developed camera on a 154 cm telescope on Mt. Lemmon. The high quantum efficiency and relatively low noise of this CCD, along with the inherently high photometric and geometric stability, opens up new opportunities for astronomical research, especially in the spectral range from 0.8 to 1.0 micrometers. For example, images of Uranus obtained in the 0.89 micrometers absorption band of methane clearly reveal for the first time markings on the disk of this remote planet. Applications for both ground based and near earth orbiting telescopes are discussed. Author

N77-17283*# IBM Watson Research Center, Yorktown Heights, N.Y.

CHARGE COUPLED DEVICE INTEGRATION-TIME CODING FOR DETECTION OF IMAGES MOVING WITH UNKNOWN VELOCITIES c35

J. M. White and G. W. Lynch *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 139-144 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

Existing techniques for the detection of a moving low light level image by a CCD array have required velocity synchronism between the image and the photogenerated charges. This was necessary to prevent blurring during the long duration of charge integration. A new detection scheme is described which causes the image to be convolved with a clock modulation signal as the photocharges are collected. The charge accumulating from each image point will now be spread over many photoelements due to the absence of velocity synchronism, but the output is not blurred in the usual sense. Instead the charge is distributed through the array in a controlled way so that the image can be reconstructed. Author

N77-17284*# California Univ., Livermore. Lawrence Livermore Lab.

A HIGH SPEED IMAGING SYSTEM FOR NUCLEAR DIAGNOSTICS c35

Harold H. Eyer *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 145-151 (For primary document see N77-17263 08-31)
(Contract W-7405-eng-48)
Avail: NTIS HC A11/MF A01 CSCL 14B

A high speed imaging system based on state-of-the-art photosensor arrays was designed for use in nuclear diagnostics. The system is comprised of a front end rapid scan solid state camera, a high speed digitizer, and a PCM line driver in a downhole package and a memory buffer system in an uphole trailer. The downhole camera takes a snapshot of a nuclear device created

flux stream, digitizes the image and transmits it to the uphole memory system before being destroyed. The memory system performs two functions: it retains the data for local display and processing by a microprocessor, and it buffers the data for retransmission at slower rates to a computational facility. In the talk, the impetus for such a system as well as its operation was discussed, along with systems under development which incorporate higher data rates and more resolution. Author

N77-17285*# Fairchild Camera and Instrument Corp., Syosset N.Y. Imaging Systems.
TELEVISION APPLICATIONS OF INTERLINE-TRANSFER CCD ARRAYS **c32**
Kenneth A. Hoagland *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 152-156 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 17B

The design features and characteristics of interline transfer (ILT) CCD arrays with 190 x 244 and 380 x 488 image elements are reviewed, with emphasis on optional operating modes and system application considerations. It was shown that the observed horizontal resolution for a TV system using an ILT image sensor can approach the aperture response limit determined by photosensor site width, resulting in enhanced resolution for moving images. Preferred camera configurations and read out clocking modes for maximum resolution and low light sensitivity are discussed, including a very low light level intensifier CCD concept. Several camera designs utilizing ILT-CCD arrays are described. These cameras demonstrate feasibility in applications where small size, low-power/low-voltage operation, high sensitivity and extreme ruggedness are either desired or mandatory system requirements. Author

N77-17286*# Texas Instruments, Inc., Dallas.
DEVELOPMENT OF LARGE AREA CCD IMAGERS **c35**
G. W. Taylor, G. A. Antcliffe, and G. L. Streckmann *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 3 p refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

High performance CCD imagers with 800 x 50 resolution elements were fabricated using a coplanar, double polysilicon, electrode system. The imager was developed as a prototype to demonstrate the feasibility of an 800 x 800 array for application to deep space photography where data rates of 10K to the 2nd power and operating temperatures of -40 C are required. The performance is discussed and comparisons made to the existing 400 x 400 imager. Author

N77-17287*# Naval Postgraduate School, Monterey, Calif.
THEORY AND APPLICATIONS OF SAMPLED ANALOG RECURSIVE CTD COMB FILTERS **c33**
T. F. Tao, S. Holmes, A. Ejaz, F. Piazza, L. Saetre, and B. Freund *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 10 p refs Sponsored in part by Naval Electronic Systems Command (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 09A

Sampled analog comb filter using a recursive filter implementation was studied. Charge transfer device delay lines were used as the delay elements. The similarities and differences between sampled analog recursive filter and digital recursive filter were pointed out. Both canceller type and integrator type comb filter using the first order or the second order canonical circuits were studied. Experimental results of frequency response are presented to show their difference from that of digital filters. A theoretical analysis was presented based essentially on the digital filter theory but modified to take into account the differences described above. The usefulness of this theory in analyzing the comb filter characteristics was discussed. Several applications of both the canceller type comb filter and the integrator type comb filter were demonstrated. Author

N77-17288*# Maryland Univ., College Park.
A PHOTON COUNTING ARRAY PHOTOMETER USING AN INTENSIFIED CHARGE COUPLED DEVICE **c35**
Douglas G. Currie *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 21 p refs (For primary document see N77-17263 08-31)
(Grant NGR-21-002-444; Contract N00014-75-C-0343; Grant NSF MPS-74-05890-001)
Avail: NTIS HC A11/MF A01 CSCL 14B

An array photometer which uses an intensified charge coupled device was developed. This system, the University of Maryland Array Photometer (UMAP), has the ability to discriminate single photoelectron events in real time at a 4 Megahertz rate. The photosensor uses an S-20 photocathode and a Fairchild CCD202 with a 100 by 100 array of separate individual channels. The overall system has demonstrated a noise level which permits single photoelectron discrimination, a scan rate of 400 frames per second, a very linear response, and very low lag. The UMAP system has a very large dynamic range exceeding 10,000 in the photon counting mode. A special technique to extend the dynamic range to 1,000,000 was described. The performance parameters of this system, both in the laboratory and on the telescope were cited. Data from these observations were discussed to illustrate the system sensitivity, which is basically limited by the pixel size in the array, rather than the electrooptics. Author

N77-17289*# Texas Instruments, Inc., Dallas.
CCD CORRELATION TECHNIQUES **c35**
C. R. Hewes, P. W. Bosshart, W. L. Eversole, M. DeWit, and D. D. Buss *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 6 p refs Sponsored by NASA Langley Res. Center (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

Two CCD techniques were discussed for performing an N-point sampled data correlation between an input signal and an electronically programmable reference function. The design and experimental performance of an implementation of the direct time correlator utilizing two analog CCDs and MOS multipliers on a single IC were evaluated. The performance of a CCD implementation of the chirp z transform was described, and the design of a new CCD integrated circuit for performing correlation by multiplication in the frequency domain was presented. This chip provides a discrete Fourier transform (DFT) or inverse DFT, multipliers, and complete support circuitry for the CCD CZT. The two correlation techniques are compared. Author

N77-17290*# Honeywell Radiation Center, Lexington, Mass.
A CCD SCANNED (Hg, Cd)Te ARRAY FOR EARTH VIEWING APPLICATIONS **c35**
S. Iwasa and W. J. White *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 6 p refs (For primary document see N77-17263 08-31)
(Contract NAS5-22339)
Avail: NTIS HC A11/MF A01

A 9 channel demonstration of 10 micrometer photoconductive mercury cadmium telluride detector array, bipolar preamplifiers, and a Si CCD multiplexer, integrated into a focal plane assembly and operating at 105 K and at 17 Hz is reported. The result of a direct coupling experiment between a 5-micrometer photovoltaic mercury cadmium telluride photodiode and a CCD is revealed. No appreciable degradation in the signal-to-noise ratio was experienced. Author

N77-17291# Osaka Univ. (Japan). Faculty of Engineering.
TECHNOLOGY REPORTS OF THE OSAKA UNIVERSITY, VOLUME 26, NOS. 1308-1336
Oct. 1976 220 p refs
Avail: NTIS HC A10/MF A01

A catalog containing information in some of the following areas is presented: (1) mathematics and physics, (2) metallurgy and welding engineering, (3) electrical and electronic engineering and (4) mechanical engineering. For individual titles, see N77-17292 through N77-17318.

N77-17292# Osaka Univ. (Japan). Dept. of Applied Physics.
ON THE BOUNDARY BEHAVIOR OF HARMONIC MEASURES **c67**
Fumio Maitani *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 373-380 refs (For primary document see N77-17291 08-31)
(Rept-1308) Avail: NTIS HC A10/MF A01

The boundary behaviors of harmonic functions whose differentials are called harmonic measures in Hilbert space due to Dirichlet's inner product were studied. Particularly, it is shown that the harmonic measures are characterized by a property of

their boundary behaviors in any Riemann surface with finite genus and countably many boundary components. These are investigated by using Kuramochi capacity on Kuramochi's compactification, and they are extended to wider classes of functions. Author

N77-17293# Osaka Univ. (Japan). Dept. of Applied Physics.
EFFECT OF SCANNING APERTURE ON THE IMAGE QUALITY OF IMAGE SCANNING SYSTEM: EXPERIMENTAL RESULTS **c74**
Tatsuro Suzuki and Youichiro Suzuki *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 381-388 refs (For primary document see N77-17291 08-31)
(Rept-1309) Avail: NTIS HC A10/MF A01

Image quality of the scanning system depends heavily on the size, shape and transmittance of the scanning apertures. Experimental results are shown of the aperture whose shape varies sinusoidally and gives better image quanty than the conventional square, rectangular or circular type apertures. Author

N77-17294# Osaka Univ. (Japan). Dept. of Nuclear Engineering.
MOTION OF CHARGED PARTICLES IN AN ADIABATIC TRAP **c75**
Tomejiro Yamagishi *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 397-402 refs (For primary document see N77-17291 08-31)
(Rept-1311) Avail: NTIS HC A10/MF A01

The effect of magnetic field inhomogeniety on the precessional drift motion is examined in the case of straight bumpy field. Formulas of the precessional drift velocity are derived by averaging over the motion along the lines of force for trapped and transit particles. An application of the formula to a stability criterion of the drift instability of plasma in a mirror is discussed. Author

N77-17295# Osaka Univ. (Japan). Dept. of Applied Physics.
RELIABILITY ANALYSIS OF A PARALLEL REDUNDANT SYSTEM WITH TWO DISSIMILAR CORRELATED UNITS **c38**
Takshi Itoi, Tatsuo Murakami, Masanori Kodama, and Toshio Nishida *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 403-410 refs (For primary document see N77-17291 08-31)
(Rept-1312) Avail: NTIS HC A10/MF A01

A parallel redundant system consisting of two dissimilar units whose failure distributions are correlated is considered. The bivariate Erlang distribution which characterizes this dependence is presented. The Laplace transform of the availability function and stationary availability are given, and the reliability and the MTSF is obtained as a special case of availability. Author

N77-17296# Osaka Univ. (Japan). Dept. of Electronic Engineering.
AN ALGORITHM FOR GENERATING ALL THE PATHS BETWEEN TWO VERTICES IN A DIGRAPH AND ITS APPLICATION **c61**
Tran Dinh Am, Shunji Tsukiyama, Isao Shirakawa, and Hiroshi Ozaki *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 411-418 refs (For primary document see N77-17291 08-31)
(Rept-1313) Avail: NTIS HC A10/MF A01

An algorithm to generate all the directed paths from a specified vertex to another one in a given directed graph is proposed. The algorithm requires the processing time bounded by the order O ((n + m)(p = 1)) and the memory space bounded by O (n + m), where n, m, and p denote the number of vertices, edges, and directed paths in a given directed graph, respectively. As an application of the algorithm, the shortest or the longest path problem path problem in a directed graph containing cycles of negative weight is also considered. Author

N77-17297# Osaka Univ. (Japan). Dept. of Welding Engineering.
KNIFE LINE ATTACK PHENOMENON IN STABILIZED STAINLESS STEELS: MECHANISM OF KNIFE LINE ATTACK PHENOMENON 2 **c26**
Hiroshi Ikawa, Shigeo Shin, Yoshikuni Nakao, and Kazutoshi Nishimoto *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 427-436 refs (For primary document see N77-17291 08-31)
(Rept-1315) Avail: NTIS HC A10/MF A01

The mechanism of knife line attack phenomenon in SUS 321 was investigated. According to the experimental results, the mechanism of knife line attack phenomenon in SUS 321 was as follows. The quantity of delta ferrite precipitated in HAZ of SUS 321 is much larger than that in SUS 347. Delta ferrite in HAZ mainly precipitate along gamma grain boundaries. By sensitizing heat treatment, the corrosion resistance of these delta ferrite deteriorate. As the result, the knife line attack sensitivity in SUS 321 increases. Therefore, it is concluded that precipitations of delta ferrite and M23C6 in HAZ are the main causes of knife line attack phenomenon in SUS 321. Author

N77-17298# Osaka Univ. (Japan). Dept. of Electrical Engineering.
CHARACTERISTICS OF InSb SPIN-FLIP RAMAN LASER PUMPED BY A TE CO2 LASER **c36**
Hideo Takamatsu, Kazuhito Yasuda, Junji Shirafuji, and Yoshio Inuishi *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 437-444 refs (For primary document see N77-17291 08-31)
(Rept-1316) Avail: NTIS HC A10/MF A01

The fundamental properties of an InSb spin flip Raman laser pumped by a transversely excited CO2 laser operated at 10.5915 micrometers were investigated. The electron concentration of the InSb cavity is 2.3 x 10 to the 16th per cu cm at 77K. The stimulated Stokes Raman output is detected at magnetic fields above 33kG when the pump intensity exceed 1.2kW. The threshold pump power density is estimated to be about 5 x 105 W/sq cm. The wavelength of the Stokes output is tuned from 11.4 to 11.8 micrometers in the magnetic field range between 33 and 50 kG. The maximum output is reached at 45kG at which the Fermi level crosses the down spin Zeeman sublevel, indicating a good agreement with the theoretical prediction. For the pump power of 10 kW the Stokes output power of excess of 100W is observed. Author

N77-17299# Osaka Univ. (Japan). Dept. of Electrical Engineering.
ANISOTROPY OF CARRIER MOBILITY AND ELECTRO-OPTICAL EFFECTS IN SMECTIC LIQUID CRYSTALS **c76**
Katsumi Yoshino, Nobuyuki Tanaka, Keiichi Kaneto, and Yoshio Inuishi *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 445-454 refs (For primary document see N77-17291 08-31)
(Rept-1317) Avail: NTIS HC A10/MF A01

The carrier mobility in the smectic liquid crystal was studied as functions of the temperature and the magnetic field. The carrier mobility in the direction perpendicular to the smectic layer is smaller than that within the smectic layer. Three different behaviors of the mobility change change, namely (1) step wise decrease in the smectic phase compared with the nematic phase (2) step wise increase (3) gradual change, were observed at the phase transition between nematic and smectic phases depending on the material. Within the layer of the smectic C phase, the carrier mobility in the direction parallel to the inclination of the molecular long axis was larger than that perpendicular direction. The increase of transmission light through liquid crystal cell by applying low electric field was observed in the smectic C phase probably due to the reorientation of molecules and the DSM like light scattering was observed both in the smectic C and A phases at higher electric fields. Author

N77-17300# Osaka Univ. (Japan). Dept. of Electrical Engineering.
ELECTRICAL PROPERTY OF POLYMERIC SULFUR NITRIDE (SN)x **c25**
In its Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 455 refs (For primary document see N77-17291 08-31)
(Rept-1318) Avail: NTIS HC A10/MF A01

Polymeric sulfur nitride (SN)Xi which is synthesized from sulfur nitride S4N4, shows the metalic behavior in the electrical and optical properties. The electrical conductivity of the obtained sample is ranged 600 difference, omega cm. which depends

strongly on the cross section and on the axes directions of the sample, indicating the quasi-one-dimentional conductor. The effective mass of (SN)Si along the fiber direction is estimated to be about 1.7 m epsilon from the Drude parameters of omega pi = 5.0 eV and tau = 1.2 10 to the minus 15 power sec which are calculated from the reflectance spectrum. Author

N77-17301# Osaka Univ. (Japan). Dept. of Electrical Engineering.
LASER-INDUCED BREAKDOWN IN ORGANIC LIQUID **c36**

Haruhisa Fujii, Katsumi Yoshino, and Yoshio Inuishi *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 461-470 refs (For primary document see N77-17291 08-31)
(Rept-1319) Avail: NTIS HC A10/MF A01

Using dimethyl silicone oil, typical dielectric liquid, the threshold fields of Nd-glass laser induced breakdown were experimentally studied as functions of mean molecular weight (or viscosity) and temperature. These were compared with the threshold fields of d.c. impulse breakdown. Laser induced photoconduction of silicone oil was also studied. The mechanism of electrical breadkown in liquids was discussed. The threshold fields of laser induced breakdown of silicone oil decreased with increasing mean molecular weight (viscosity), and increased a little with increasing temperature. On the other hand, the threshold fields of d.c. impulse breakdown slightly increased with increasing mean molecular weight, and decreased with increasing temperature. From these results, it is suggested that the microwave breakdown theory is applicable as the mechanism of laser induced breakdown in liquids. Author

N77-17302# Osaka Univ. (Japan). Dept. of Electrical Engineering.
EFFECT OF SURFACTANT ON THE FLUORESCENCE OF DYE SOLUTION **c25**

Jun-ichic Nakata, Takeshi Imura, and Kazuo Kawabe *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 471-476 refs (For primary document see N77-17291 08-31)
(Rept-1320) Avail: NTIS HC A10/MF A01

Fluorescence intensity of rhodamine 6G aqueous solution was measured at various concentration of additional surfactant. The fluroescence intensity increased with increasing surfactant concentration up to about 1%, above which the intensity was saturated. The lasing ability of these solutions was examined under the excitation of a nitrogen laser. The solutions of the saturated fluorescence intensity could lase. Several other dyes also lased in the aqueous solution containing 1.6% of the surfactant. Author

N77-17303# Osaka Univ. (Japan). Dept. of Electrical Engineering.
INTERACTION OF TEA CO2 LASER LIGHT WITH LASER PRODUCED PLASMA **c36**

Chobei Yamabe (Nagoya Univ.), Eiji Setoyama, Hisayoshi Nakakita, Akira Miyazaki, Aye Thein, Yoneyoshi Kitagawa, Masahiro Yokoyama, and Chiyoe Yamanaka *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 477-486 refs (For primary document see N77-17291 08-31)
(Rept-1321) Avail: NTIS HC A10/MF A01

The experimental results of the anomalous absorption due to the parametric instability of the laser produced plasma by focusing the double discharge type TEA CO2 laser light on the targets of carbon plate, polyethylene terephthalate film and polyethylene plate are described. The higher harmonics generation from laser produced plasma is also observed. Author

N77-17304# Osaka Univ. (Japan). Dept. of Electrical Engineering.
HEATING OF PLASMA FOCUS BY TES CO2 LASER, 1 **c75**

Aye Thein, Yoneyoshi Kitagawa, Akira Miyazaki, Hisayoshi Nakakita, Eiji Setoyama, Chobei Yamabe (NAGOYA Univ.), Masahiro Yokoyama, and Chiyoe Yamanaka (Nagoya Univ.) *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 487-798 refs (For primary document see N77-17291 08-31)
(Rept-1322) Avail: NTIS HC A10/MF A01

Intense neutron yield 10 to the 9th power - 10 to the 10th power per shot from deuterium plasma by D-D reaction is observed and is increased by applying higher condenser energy with the scaling law of plasma focus, but up to some limit only, due to its geometry. Density measurement shows the life time of plasma density above laser cutoff density is more than 200 ns. Hydrogen plasma is heated from 6 keV to 8 keV by the irradiation with TEA CO2 laser pulse energy of 63 J. Author

N77-17305# Osaka Univ. (Japan). Dept. of Electronic Engineering.
VARIABLE SAMPLING RATE CODER **c60**

Keiichi Murakami, Keihachiro Tachibana (Nagasaki Coll. of Naval Architecture), Hiroshi Fujishita (TOA Electric Co., Ltd., Kobe), and Koichi Omura *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 499-508 refs (For primary document see N77-17291 08-31)
(Rept-1323) Avail: NTIS HC A10/MF A01

A design of a real time hardware simulator which used the variable sampling rate CODEC for TV signals was described. the simulator reduces the bit-rate of 1 MHz video signals to about 1/5 comparing with 8 bits PCM system, maintaining satisfactory picture quality. Author

N77-17306# Osaka Univ. (Japan). Dept. of Mechanical Engineering.
LINEAR VISCOELASTIC MEDIA WITH HIDDEN PARAMETERS [MILIEUX VISCOELASTIQUES LINEAIRES AUX PARAMETRES CACHES] **c77**

Kiyoji Nakamura *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 509-516 refs In FRENCH (For primary document see N77-17291 08-31)
(Rept-1324) Avail: NTIS HC A10/MF A01

An extension of the method for irreversible local state thermodynamics was used to present viscoelastic potential and a dual formulation. The results are described by parameters called hidden parameters and the laws of viscoelastic behavior are applied to the hidden parameters regardless of the linear viscoelastic body. Transl. by B.B.

N77-17307# Osaka Univ. (Japan). Dept. of Mechanical Engineering.
PHOTOELASTIC INVESTIGATION ON THE THERMAL STRESSES CAUSED BY A TRAVELING HEAT SOURCE **c39**

Hiroshi Kitagawa, Mamoru Furukawa (Kobe Univ. of Mercantile Marine), Takuo Hayashi, and Minoru Hamada *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 517-526 refs (For primary document see N77-17291 08-31)
(Rept-1325) Avail: NTIS HC A10/MF A01

Photothermoelastic experiments were carried out for thermal stress fields caused by a traveling heat source. A copper block heated by an electric heater element was used as a heat source which was moved in contact with the model strip of epoxy resin along its upper edge. The traveling isochromatic fringe patterns were photographed by a fixed camera. The temperature distribution was measured quasi-stationarily by iron-constantan thermocouples embedded in the model. The experimental data agreed well with the theoretical solutions calculated by the finite-difference method. Author

N77-17308# Osaka Univ. (Japan). Dept. of Mechanical Engineering.
ON THE AXI-SYMMETRIC LAMINAR FLOW OF LIQUID JET **c34**

Yutaka Miyake and Chihiro Yamaji *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 527-538 refs (For primary document see N77-17291 08-31)
(Rept-1326) Avail: NTIS HC A10/MF A01

The axi-symmetric liquid jet of steady laminar viscous flow at high Reynolds number through a pipe with constant diameter was considered. The solution was obtained by utilizing the matched asymptotic expansion technique. Author

N77-17309# Osaka Univ. (Japan). Dept. of Mechanical Engineering.

HEAT TRANSFER TO WATER FLOW IN A TUBE UNDER VERY HIGH PRESSURE **c34**

Seikan Ishigai, Masuo Kaji, Shinichi Takai (Kobe Steel Co., Ltd.), and Takashi Izumi (Mitsubishi Atomic Power industries, Inc.) *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 539-546 refs (For primary documeht see N77-17291 08-31)

(Rept-1327) Avail: NTIS HC A10/MF A01

Heat transfer characteristics for water flow in a tube was investigated by experiments under pressures from two to three times the critical pressure. Abnormality in heat transfer as seen in the near-critical region did not appear. But the heat transfer coefficient deterioration due to the physical property variation with temperature was observed at very high heat flux. The conventional turbulent flow model using the eddy diffusivity gave considerably smaller heat transfer coefficient when the heat flux was high. The Dittus-Boelter's empirical correlation gave good agreement with the experimental data when the film temperature was selected as the reference temperature. Author

N77-17310# Osaka Univ. (Japan). Dept. of Mechanical Engineering for Industrial Machinery.

SIMULTANEOUS MEASUREMENT OF LOCAL LIQUID VELOCITY AND VOID FRACTION IN BUBBLY FLOWS USING A GAS LASER. PART 1: PRINCIPLE AND MEASURING PROCEDURE **c34**

Kenkichi Ohba, Ichiro Kishimoto, and Mitsunobu Ogasawara *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 547-556 refs (For primary document see N77-17291 08-31)

(Rept-1328) Avail: NTIS HC A10/MF A01

A laser beam was modulated in frequency and attenuated in light intensity during its passes through the bubbly flow. The modulation rate in frequency gave the local liquid velocity and the attenuation rate in light intensity gave the line void fraction. The developed laser Doppler velocimeter was confirmed to give accurately the local liquid velocity and its turbulence intensity in bubbly flows. An equation giving the relation between the beam transmission rate and the void fraction was deduced theoretically and confirmed experimentally on the assumption that the bubble size distribution was given. Author

N77-17311# Osaka Univ. (Japan). Dept. of Precision Engineering.

ELASTIC EMISSION MACHINING **c37**

Yuzo Mori, Naoya Ikawa, and Kazuhisa Sugiyama *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 557-566 refs (For primary document see N77-17291 08-31)

(Rept-1329) Avail: NTIS HC A10/MF A01

The feasibility of elastic emission machining is proved, experimentally by the measurement of stock removal and the microscopic and electron diffraction observations of finished surface, and theoretically by comparing the kinetic energy of powder particle with the binding energy of material and comparing the stress induced by the collision of powder particle with the theoretical strength of material. Author

N77-17312# Osaka Univ. (Japan). Dept. of Mechanical Engineering for Industrial Machinery.

A DESIGN OF SCHEDULING SIMULATOR OF MULTI-STAGE PRODUCTION SYSTEM **c37**

Katsundo Hitomi, Nobuto Nakamura, Takayoshi Tamura (Nagoya Inst. of Technology), and Hiroki Azukizawa (Kobe Steel Industry Co., Ltd.) *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 567-574 refs (For primary document see N77-17291 08-31)

(Rept-1330) Avail: NTIS HC A10/MF A01

A scheduling simulator of a multi-stage production system, which is constructed for production involving machining, part assembly, and final assembly subsystems, was designed for decision-making purposes relative to scheduling. Some results of simulation experiments using this simulator were described. Author

N77-17313# Osaka Univ. (Japan). Dept. of Mechanical Engineering.

AIR JET DRIVEN OPEN-END SPINNING **c37**

Osamu Yaida and Akira Horikawa *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 575-582 refs (For primary document see N77-17291 08-31)

(Rept-1331) Avail: NTIS HC A10/MF A01

Air jet driving and supporting device was tested for a high speed open-end spinning frame. The rotor was driven by air jets gushing out upon rotor flutings directly from the nozzles prepared on the inner surface of the stator. The rotor was supported on the stator by the pressure of air jets. Series of tests were made for this device changing rotor conical angle and number and angle of flutings, and driving air pressure. Author

N77-17314# Osaka Univ. (Japan). Dept. of Naval Architecture.

AN EXACT INTEGRAL METHOD FOR SOLVING THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER EQUATION AROUND SHIP HULLS **c34**

Joji Himeno (Univ. of Osaka Prefecture, Sakai) and Ichiro Tanaka *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 583-594 refs Submitted for publication (For primary document see N77-17291 08-31)

(Rept-1332) Avail: NTIS HC A10/MF A01

The equations in the streamline coordinates are solved through the transformation to the coordinates defined by a n-parameter mapping function. Author

N77-17315# Osaka Univ. (Japan). Dept. of Civil Engineering.

NONLINEAR ANALYSIS OF REINFORCED CONCRETE SLABS BY FINITE ELEMENT METHOD **c39**

Yukio Maeda, Shigeyuki Matsui, and Ichio Kojima *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 595-604 refs (For primary document see N77-17291 08-31)

(Rept-1333) Avail: NTIS HC A10/MF A01

The analytical procedures were outlined. Then, the overall load-deflection response, cracking behavior and distribution of stress or strains are investigated with numerical calculation examples. Author

N77-17316# Osaka Univ. (Japan). Dept. of Civil Engineering.

ELASTO-PLASTIC ANALYSIS OF THIN-WALLED STRUCTURES BY FINITE STRIP METHOD **c39**

Yukio Maeda, Masa Hayashi, and Ken-ichi Arioka *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 605-616 refs (For primary document see N77-17291 08-31)

(Rept-1334) Avail: NTIS HC A10/MF A01

Some improvements for the finite strip method were made on the displacement functions which satisfy the continuity condition for strains in each plate of which a structure was composed, and incremental equilibrium equations and expressions of equivalent stiffness of stiffners were derived. Some numerical applications to stiffened plate girders were given, and the results are discussed. Author

N77-17317# Osaka Univ. (Japan). Dept. of Petroleum Chemistry.

REACTION OF XYLENE WITH AMMONIA **c23**

Akira Uchida, Hisakazu Hayaoka, and Sumio Matsuda *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 617-622 refs (For primary document see N77-17291 08-31)

(Rept-1335) Avail: NTIS HC A10/MF A01

The reaction of o-xylene with ammonia over twenty six sorts of catalysts was investigated at 520 C. Catalysts such as WO3-Al2O3, CoO-MgO-Al2O3, CoO-CdO-Al2O3, NiO-Al2O3, CoO-Al2O3,CoO-CuO-Al2O3, CoO-Fe2O3-Al2O3, CoO-SrO-AlwO3, CoO-SnO-Al2O3, CoO-UO2-Al2O3, CoO-Ag2O-Al2O3, or CoO-PbO-Al2O3 catalyze the demethylation of o-xylene, and catalysts such as NiO-Al2O3, MoO3-Al2O3, CoO-MoO3-Al2O3, or CoO-BaO-Al2O3 promote the decomposition of ammonia. However, catalysts such as Cr2O3-Al2O3, CoO-MnO-Al2O3, MnO-Al2O3, CoO-ZnO-Al2O3, or CoO-K2)-Al2O3 are useful catalysts for the synthesis of aromatic nitriles. Author

N77-17318# Osaka Univ. (Japan). Dept. of Petroleum Chemistry.

OXIDATION OF ALDEHYDES BY HYDROGEN PEROXIDE

IN THE PRESENCE OF SELENIUM DIOXIDE CATALYST
c23

Yasutaka Ishii (Kansai Univ.), Shinji Murai, and Noboru Sonoda *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p623-626 refs (For primary document see N77-17291 08-31)
(Rept-1336) Avail: NTIS HC A10/MF A01

Oxidation of aliphatic aldehydes with hydrogen peroxide was carried out in the presence of selenium dioxide catalyst, and the corresponding acids were obtained in excellent yields. The reaction mechanism was discussed in connection with that postulated for the oxidation of ketones. Author

N77-17319# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE EVAPORATION OF CONDENSED SUBSTANCE IN A VACUUM

I. E. Poiurovskaia [1976] 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 3, 1976 p 163-165
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Boundary conditions connecting the values of the hydrodynamic variables in a rarefaction wave with the surface temperature were obtained. The gas-kinetic problem of vapor motion in a thin layer directly adjacent to the phase boundary was solved approximately. If the constant surface temperature is sustained by using external radiation, the solution obtained permits calculation of the surface temperature, the velocity of the evaporation front, and the recoil pulse. Author

N77-17320# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
THE NATIONAL MEASUREMENT SYSTEM FOR LENGTH AND RELATED DIMENSIONAL MEASUREMENTS, PART 1 Final Report

J. W. Lazar and R. L. Bach Aug. 1976 115 p refs
(PB-257467/1; NBSIR-75-926-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 14B

The greater accuracy requirements of some industries brought new measurement techniques into use, e.g. the fringe counting laser interferometer systems now used in many tool rooms and metrology laboratories. No deficiencies were found in the system but only in individuals or the measurement technique that they use as shown in the comparison measurement on audit packages that were made by the various standards laboratories. GRA

N77-17321# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
THE NATIONAL MEASUREMENT SYSTEM FOR TEMPERATURE Final Report

James F. Schooley Dec. 1975 58 p refs
(PB-257425/9; NBSIR-75-932) Avail: NTIS HC A04/MF A01 CSCL 14B

Attempts are made to portray its great diversity of products, services, and people. The system is largely organized, as might be expected, for the purpose of economic gain; in those areas where highly accurate or intricate thermometry is essential. GRA

N77-17322# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
MODELS FOR THE INTERPRETATION OF FREQUENCY STABILITY MEASUREMENTS Final Report

James A. Barnes Aug. 1976 48 p refs
(PB-258083/5; NBS-TN-683) Avail: NTIS HC A03/MF A01 CSCL 14B

The results of measurements of frequency stability are interpreted in the terms of models. Typically, these models are expressed as a power-law for the power spectral density. The experiments which provide the basis for these models are limited in their range and include neither zero nor infinite Fourier frequency. These problems are associated with the model and not the actual oscillators being modeled. By carefully taking into account actual limits of the device, and constraining discussions to be concerned only with quantities which can be observed in a practical sense, the problems of nonconvergence and nonstationarity are avoided. There is evidence that the typical Gaussian models may be inadequate. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N77-17323 Florida Univ., Gainesville.
A SIGNAL DETECTION FROM NOISE UTILIZING ZERO-CROSSING INFORMATION Ph.D. Thesis

Woon Cheon Yeo 1975 145 p
Avail: Univ. Microfilms Order No. 77-139

The operating characteristic of the zero-crossing measuring detector is analyzed in a model with signals of sine wave form imbedded in a stationary bandlimited white Gaussian noise. Then, to observe the operating characteristic of the detector in a complex situation, the detector is analyzed under deviated conditions of signals and noise from the assumptions. The performance of a correlation detector is also analyzed under identical conditions, as a comparative reference to the performance of the zero-crossing measuring detector. The operating characteristics of the zero-crossing measuring detector is shown to be effective in detecting phasic events from a sleep electroencephalogram, where the process of the signals and noise is very complex. Dissert. Abstr.

N77-17324 Communications Research Centre, Ottawa (Ontario).
CALCULATION OF RADIOWAVE ATTENUATION DUE TO RAIN AT FREQUENCIES UP TO 1000 GHz

D. V. Rogers and R. L. Olsen Nov. 1976 38 p refs
(CRC-1299) Copyright. Avail: Issuing Activity

Problems in calculating appropriate values of specific rain attenuation for application to the design of communications system are analyzed. A set of design curves based on Mie scattering theory and the Laws Parsons dropsize distribution is presented for the frequency range 1 to 1000 GHz. These curves allow the temperature dependence of rain at the lower frequencies to be taken into account more simply than at present. The possibility of extrapolating the calculations for 'Laws and Parsons' rain to rainrates of 400 mm/h is discussed. On the basis of multiple scattering theory, it is shown that the so-called 'single scattering theory' actually includes all the forward multiple scattering processes, and that is only these processes which contribute significantly to the coherent wave. The effect of the backward multiple scattering processes neglected in the normal calculation procedure is illustrated numerically. Author

N77-17325*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SURFACE ROUGHNESS MEASURING SYSTEM Patent Application

Atul Jain, inventor (to NASA) (JPL) Filed 24 Nov. 1976 42 p
(Contract NAS7-100)
(NASA-Case-NPO-13862-1; US-Patent-Appl-SN-744577) Avail: NTIS HC A03/MF A01 CSCL 17I

The technique is based upon processing a signal obtained from a synthetic aperture imaging radar for correlation of different images of ocean waves, or peaks of rough terrain utilizing means for compressing the radar signal over different widths of the available chirp or Doppler bandwidths, and means for cross correlating one of these images with each of the others. The measured height is the slope of the cross correlation value determined to the spacing value used. Both electronic and optical radar signal data compressors and cross-correlations are disclosed for implementation of the system. Author

N77-17326*# Radio Sciences Co., Lowell, Mass.
CHARACTERISTICS OF MAGNETOSPHERIC RADIO NOISE SPECTRA Final Report, Dec. 1974 - Dec. 1975

John R. Herman 22 Jan. 1976 83 p refs
(Contract NAS5-20807)
(NASA-CR-144843; RSCR-76-1) Avail: NTIS HC A05/MF A01 CSCL 20N

Magnetospheric radio noise spectra (30 kHz to 10 MHz) taken by IMP-6 and RAE-2 exhibit time varying characteristics which are related to spacecraft position and magnetospheric

processes. In the midfrequency range (100-1000 kHz) intense noise peaks rise a factor of 100 or more above background; 80% of the peak frequencies are within the band 125 kHz to 600 kHz, and the peak occurs most often (18% of the time) at 280 kHz. Bandwidths of the peaks range from about 100 kHz to more than 500 kHz; most often the lower cutoff is at about 100 kHz and the upper at 380 kHz for a total bandwidth of 280 kHz. This intense mid-frequency noise was detected at radial distances from 1.3 Re to 60 Re on all sides of the earth (i.e., all local times) during magnetically quiet as well as disturbed periods. Maximum occurrence of the mid-frequency noise is in the evening to midnight hours where splash-type energetic particle precipitation takes place. Author

N77-17327# Royal Signals and Radar Establishment, Christchurch (England).
THE USE OF AN ITERATIVE ALGORITHM FOR THE IMPROVEMENT OF THE SIGNAL-TO-NOISE RATIO OF TV SIGNALS
D. E. Vaughan and J. M. Williams May 1976 27 p
(RSRE-76014; BR53259) Avail: NTIS HC A03/MF A01

The requirements of a TV averaging process are discussed and the use of a particular iterative algorithm is proposed as a feasible basis for implementation. The behavior of the algorithm is analyzed and the relation to a digital filter is developed. Some of the problems of the hardware implementation are also discussed. ESA

N77-17328# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF SATELLITE DATA ON PRECIPITATING PARTICLES IN COORDINATION WITH ELF PROPAGATION ANOMALIES Annual Report
William L. Imhof, Trygve R. Larsen, Joseph B. Reagan, and Edward E. Gaines 30 Apr. 1976 105 p refs
(Contract N00014-75-C-0954)
(AD-A028793; LMSC-D502063) Avail: NTIS HC A06/MF A01 CSCL 20/14

The report describes the analyses of satellite energetic particle data for coordination with ELF transmission anomalies. The precipitating electrons typically exhibit pronounced flux and spectral variations on a small latitude scale. The electron fluxes and energy spectra, when averaged over a wide latitude interval, are presented as well as the resulting ion-pair production rates and the free electron concentrations in the lower ionosphere. Significant enhancements over the quiet-time night profiles were often observed. The particle measurements indicated significant enhancements in the D-region electron densities during all of the times of the ELF transmission anomalies. Based on the electron and ion concentrations a waveguide model computer program, which was developed at the Naval Electronics Laboratory Center, was used to calculate the mode constants applicable in the extremely low frequency range. The program predicts the measured field strengths in an undisturbed uniformly stratified ionosphere, but for the nights of enhanced ionization the calculated field strengths indicate increases in contrast to the observed decreases. GRA

N77-17329# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
AUTOMATIC MEASUREMENT OF NETWORK PARAMETERS: A SURVEY Final Report
R. W. Beatty Jun. 1976 115 p refs
(PB-258045/4; NBS-MN-151) Avail: NTIS HC A06/MF A01 CSCL 14B

A survey is made of principles, methods, and systems developed for semi-automatic and automatic measurement of network parameters, such as the complex scattering coefficients, impedance, VSWR, return loss, attenuation, and group delay time. The period covered is from 1922 to 1975, and developments range from simple ideas such as a motor driven probe for a slotted line, to computer-controlled transmission and reflection measurement systems. The essential ideas and features of each development are briefly described, and both similarities and differences between various schemes are pointed out. Trends in modern developments are noted, and some of the options open for future work are mentioned. GRA

N77-17330# Systems Applications, Inc., San Rafael, Calif.
REFINEMENT AND PILOT-TESTING OF A PROCESS FOR GENERATION AND USE OF FREQUENCY REQUIREMENTS PLANS Final Report
Peter Stanek 29 May 1976 288 p refs
(Contract TP-5AC012)
(PB-257243/6; TF76-175) Avail: NTIS HC A13/MF A01 CSCL 17B

The study develops a process for the determination of radio frequency spectrum demand, and tests on a limited basis the application of this process in three Government agencies (NASA FAA and USAF). The process involves the development of frequency requirement projections for short, immediate and long time frames. These projections are based on agency derived spectrum demand determinations, e.g., number of landings and takeoffs, number of launches, number and type of projected missions, budget projections, etc. A process is defined for evaluation of agency spectrum projections and the determination of spectrum impact. GRA

N77-17331# Mission Research Corp., Santa Barbara, Calif.
A NON-REFLECTING ELECTROMAGNETIC OUTER BOUNDARY CONDITIONS FOR CYLINDRICAL COORDINATES AND THE SGEMP PROBLEM Technical Report, 1 Oct. 1974 - 30 Jun. 1975
Roger Stettner and Robert Marks Jun. 1975 28 p refs
(Contract DNA001-75-C-0125; DNA Proj. NWED-QAXEB069)
(AD-A027956; MRC-R-194; DNA-3890T) Avail: NTIS HC A03/MF A01 CSCL 20/14

The outer, non-reflective boundary condition for the numerical solution of the full time dependent set of Maxwell's equations for the SGEMP problem is discussed. A boundary condition which has a fractional error of roughly lambda/2 pi R (lambda is the maximum wavelength of the radiation, R is the distance from the origin to the boundary) is defined and tested for an axially symmetric system in cylindrical coordinates and real time. Boundary condition schemes with greater potential accuracy are considered. GRA

N77-17332# Naval Postgraduate School, Monterey, Calif.
MEASURED SURFACE CHARGE AND CURRENT DISTRIBUTIONS ON SCATTERING RECTANGULAR PLATES M.S. Thesis
Hans-Joachim Wiedman and Robert W. Burton Jun. 1976 145 p refs Sponsored in part by AFWL
(AD-A028206; NPS-52ZN76501) Avail: NTIS HC A07/MF A01 CSCL 20/14

The work describes the measurement of surface charge and current distributions on rectangular conducting plates under monochromatic, electromagnetic illumination. Different plate widths and angles of incidence are investigated. The results are graphed, analyzed and compared to theoretical computations. GRA

N77-17333# Naval Underwater Systems Center, New London, Conn.
A STUDY OF THE DISTRIBUTION OF EXTREMELY LOW FREQUENCY (ELF) ELECTROMAGNETIC FIELDS IN THE OCEAN NEAR A SHORELINE
Emil F. Soderberg 29 Jun. 1976 51 p refs
(AD-A027831; NUSC-TR-5441) Avail: NTIS HC A04/MF A01 CSCL 20/14

Measurements of extremely low frequency (ELF) noise in the sea were made to determine the distribution of underwater electromagnetic fields near a shoreline as a function of depth below the sea surface. The source of this noise is predominantly atmospheric noise from thunderstorm activity, which occurs almost continuously over the surface of the earth. The atmospheric noise penetrating into the sea is at first found to be attenuated with depth by the skin depth effect of the sea water. However, as one approaches the ocean bottom the level of ELF noise appears to increase in some cases, suggesting the possibility that contributions of ELF energy are entering the sea from the ocean bottom. In this study, a modified wedge model of the ocean is used to represent the ocean near a shoreline, and the ELF electromagnetic fields are described for various regions of the model: the deep ocean, the shallow ocean, and the coastal waters. This model is intended to help establish

guidelines for the design of future measurements of underwater ELF fields. Experimental data obtained by the author and others are discussed and evaluated, and proposal is made for further work. Author (GRA)

N77-17334# Illinois Univ., Chicago. Communications Lab.
PROCEEDINGS OF NATIONAL CONFERENCE ON ELECTROMAGNETIC SCATTERING Interim Report
Piergiorgio L. E. Uslenghi Jun. 1976 232 p refs Conf. held at Chicago Circle, 15-19 Jun. 1976
(Grant AF-AFOSR-2888-76; AF Proj. 9749)
(AD-A027868; AFOSR-76-0868TR; Rept-76-1) Avail: NTIS HC A11/MF A01 CSCL 20/3

Summaries of 78 papers presented at the National Conference on Electromagnetic Scattering, held at the University of Illinois at Chicago Circle on June 15-18, 1976. Author (GRA)

N77-17335# Mission Research Corp., Santa Barbara, Calif.
TIME DEPENDENT, ANALYTIC, ELECTROMAGNETIC SOLUTION FOR A HIGHLY CONDUCTING SPHERE
Roger Stettner Mar. 1976 27 p refs
(Contract DNA001-76-C-0086; DNA Proj. NWED-QAXEB069)
(AD-A028636; MRC-R-258; DNA-3910T) Avail: NTIS HC A03/MF A01 CSCL 20/3

The time-dependent, analytic solution for the electromagnetic, axisymmetric, highly conducting sphere problem is derived in terms of arbitrary, spatial current sources. In particular, the skin current at the surface is shown to be determined by the modes of oscillation of the sphere together with the field due only to the spatial current sources, at the surface of the sphere. GRA

N77-17336# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
IMPLEMENTATION OF THE NOTCH TECHNIQUE AS AN RF PEAK PULSE POWER STANDARD
Philip Simpson and Paul A. Hudson Jul. 1976 33 p refs
(PB-258086/8; NBS-TN-682) Avail: NTIS HC A03/MF A01 CSCL 14B

The theory and operation of a standard for measuring RF peak pulse power is described. The standard is based on the notch principle. It is constructed in coax for frequencies up to 4.4 GHz, and in WR-90 waveguide. The basic range is 1 to 10 mW but is extendable to cover 10 microwatt to 10 KW using directional couplers. Risetime of the system is 14 nanoseconds. A comprehensive error analysis is given. GRA

N77-17337# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
RESEARCH IN COMMUNICATION THEORY Final Report, 1 May 1973 - 15 Jun. 1976
L. R. Welch and R. A. Scholtz Aug. 1976 11 p refs
(Grant DA-ARO(D)-31-124-73-G153)
(AD-A028826; ARO-11506.5-EL) Avail: NTIS HC A02/MF A01 CSCL 09/4

Results are presented in the areas of signal design bounds, spread spectrum communications, the partial correlation properties of gold codes, the design of special signal sets for good correlation, signal design for totally phase-incoherent communications, the detection of moderately fluctuating Rayleigh targets, and coded channels with memory. Author (GRA)

N77-17338# Army Electronics Command, Fort Monmouth, N.J.
ANTENNA ARRAY FOR LIMITED SCAN APPLICATIONS Technical Report, Jan. 1975 - Jun. 1976
R. A. Stern Jul. 1976 15 p refs
(DA Proj. 1S7-62705-AH-94A)
(AD-A029219; ECOM-4423) Avail: NTIS HC A02/MF A01 CSCL 09/5

A novel type of S-band line source antenna is described which could become the basis for a relatively lightweight, compact, low cost phased array. The line source is a series-fed array of radiating slots periodically situated in the side wall of an S-band waveguide section. The unit, which utilizes nonreciprocal, latching, ferrite phase shifters situated between adjacent slots, is capable of switching beam position in less than 10 micro sec and is designed to operate at peak power levels = 3Kw. Author (GRA)

N77-17339# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SIMULATION OF A NARROW BANDPASS-LIMITED SATELLITE CHANNEL
Brian E. White 28 Jul. 1976 83 p refs
(Contract F19628-76-C-0002)
(AD-A030411; TN-1976-10; ESD-TR-76-219) Avail: NTIS HC A05/MF A01

The effects of a bandpass-limiting satellite channel, such as a B-25-kHz hard-limiting FLEETSAT channel, on several modulation techniques were simulated. The modulations included BPSK and various forms of QPSK, including offset QPSK and continuous-phase minimum frequency shift keying (MSK). Coherent matched-filter receivers and both uplink and downlink noise were assumed. For a bit error probability of 0.005 and a SNR loss of less than 1 dB caused by the nonlinearity in the FLEETSAT case, the maximum standard data rate R was 19.2 kbps for BPSK but 32 kbps for offset QPSK, MSK and QPSK. Rates of 24 kbps for BPSK and 48 kbps for offset QPSK and MSK were attainable at this same reliability with a SNR degradation of about 4 dB and 2.5 dB, respectively. Larger degradations are expected at lower error rates. Author (GRA)

N77-17340# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
DATA NETWORK RELIABILITY Annual Report, 1 Jul. 1975 - 30 Jun. 1976
R. G. Gallager, A. Segall, and John M. Wozencraft Jul. 1976 64 p refs
(Contract N00014-75-C-1183; ARPA Order 3045; NR Proj. 049-383)
(AD-A030012; ESL-IR-677; AR-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

The objective of this research is how to achieve in engineering practice the potential advantages of reliability that a large scale data communication network should make possible. From a technical viewpoint, the principal areas of investigation reported here are computer resource sharing, adaptive network routing, and the efficient representation of network protocol information. The approach has been theoretical, with an attempt made to take a fundamental new look independent of current engineering practice at areas where theoretical understanding is limited, but important and possible to attain. The primary analytical tools have been information, control, and queueing theory. Author (GRA)

N77-17341# Ballistic Research Labs., Aberdeen Proving Ground, Md.
BLAST TESTS OF A MOBILE SATELLITE TRACKING ANTENNA AND OF TWO MODEL ANTENNAS Final Report
Rodney Abrahams, Brian P. Bertrand, and Richard J. Pearson Aug. 1976 65 p refs
(DA Proj. 1W1-62118-AH-75)
(AD-A029437; BRL-MR-2661) Avail: NTIS HC A04/MF A01 CSCL 17/2

A mobile satellite tracking antenna was subjected to blast waves emerging from the open end of an eight foot diameter shock tube. Response data were obtained by the use of strain gages and an accelerometer. Two similarly instrumented simple model antennas were also tested within the shock tube. Author (GRA)

N77-17342# American Electronic Labs., Inc., Lansdale, Pa.
LOW-LEVEL MODULATOR DEVELOPMENT Final Report, 1 Dec. 1975 - 9 Jul. 1976
Donald L. Talhelm 9 Jul. 1976 16 p
(Contract N00014-74-C-0393; AEL Proj. 10077)
(AD-A029651) Avail: NTIS HC A02/MF A01 CSCL 09/5

This report summarizes the development of a C/X Band Low Level Modulator. Test data on insertion loss, isolation, and response time are included. Author (GRA)

N77-17343# Threshold Technology, Inc., Delran, N.J.
KEY WORD RECOGNITION Final Technical Report
E. F. Grunza Griffiss AFB, N.Y. RADC Jul. 1976 81 p refs
(Contract F30602-74-C-0101; AF Proj. 7055)
(AD-A029201; RADC-TR-76-211) Avail: NTIS HC A05/MF A01 CSCL 05/7

This report describes the design, development and feasibility evaluation of a key word recognition system designed to detect key words/phrases embedded in narrow bandwidth conversational speech. It has been a goal that the techniques developed during this program be independent of the speaker. A real-time, dual processing level, key word recognition technique has been developed during this program. The technique utilizes the occurrence of a sequence of phonemic events to identify a candidate key word. A fine grained analysis is then performed on the speech segment containing the candidate word to determine if it is the key word of interest. A series of narrow band data recordings have been generated during the course of this investigation. An improved sequential logic element has been developed and the features and programmable sequential logic system of the RADC Voice Information Processor (VIP) has been interfaced to a minicomputer. GRA

N77-17344# University of Southern Calif., Los Angeles.
SPECIAL TOPICS IN COMMUNICATIONS RESEARCH Final Progress Report, 1 Jun. 1973 - 31 May 1976
Solomon W. Golomb 26 Jul. 1976 26 p refs
(Contract DA-ARO(D)-31-124-73-G167; DA Proj. 1T1-61102-B-14E)
(AD-A029406; ARO-11547.5-EL; FPR-301) Avail: NTIS HC A03/MF A01 CSCL 17/2

This Final Report contains a brief overview of activities and accomplishments under the subject Grant, including a list of publications submitted and/or published by journals, degrees awarded, and a summary of some of the major technical achievements. It also incorporates the four Interim Progress Reports on this project as appendices. Author (GRA)

N77-17345# North American Aviation, Inc., Columbus, Ohio.
TARGET ACQUISITION PERFORMANCE WITH AN AIRBORNE TELEVISION SYSTEM. PART 2: HIGH-ALTITUDE, HIGH-SPEED STUDY
G. W. Levy Jun. 1976 38 p
(AD-A030204; NA-63H-1078-Pt-2; NMC-TP-5862-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 17/8

The report describes a simulation study of target acquisition performance with an air-to-ground television system. The study provides data on success probability and slant range at acquisition as a function of flight profile, velocity, and meteorological range. The task of the observer in the study was to search and acquire a prebriefed target area, acquire the target, and center the target on the TV display. The performance measures were: probability of target area acquisition, target acquisition, and lock-on, and slant range to the target at target area acquisition, target acquisition, and lock-on. GRA

N77-17346# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A CLASS OF THRESHOLD DECODABLE BLOCK CODES
Barney Reiffen 23 Jul. 1976 18 p refs
(Contract F19628-76-C-0002; AF Proj. 1227)
(AD-A029895; ESD-TR-76-218; TN-1976-33) Avail: NTIS HC A02/MF A01 CSCL 17/2

A class of binary block codes is defined which is easily decodable. The parity check matrices of these codes are completely orthogonalized, permitting single-step threshold decoding of each received information bit to take place. Several examples with minimum distances equal to or greater than 4 are given and compared to the Gilbert bound. Author (GRA)

N77-17347# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
LARGE TIME BANDWIDTH SYNCHRONIZATION PREAMBLES Final Report, 15 Apr. 1975 - 9 Apr. 1976
J. Wheeler and C. M. Hurd Jul. 1976 160 p
(Contract F30602-75-C-0184; AF Proj. 5556)
(AD-A029738; RADC-TR-76-227) Avail: NTIS HC A08/MF A01 CSCL 17/2

The report presents the results of the Large Time Bandwidth Synchronization Preamble Program which developed a technique for detecting large time-bandwidth synchronization preambles in Time Division Multiple Access (TDMA) systems. The preamble detector provides synchronization preambles on a burst by burst basis in the presence of a large doppler frequency shift and in the presence of sophisticated jammers. A baseline preamble waveform and preamble detector which meets the stated objectives was developed. The chosen approach used a combination of predetection correlation and post-detection correlation to provide the desired detection characteristics with minimum hardware. A breadboard test model was built, and a production model configuration costing less than $2K was developed. The baseline concept embodied a compromise between tried and proven hardware and relatively undeveloped new devices to achieve a full 800 chip correlation with an addressing function. GRA

N77-17348# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
ADAPTIVE BASEBAND DIGITAL COMMUNICATION AND APPLICABLE CONVERGENCE RESULTS
David C. Farden, L. L. Scharf, and M. M. Siddiqui Sep. 1976 54 p refs
(Contracts N00014-75-C-0518; N66001-75-C-0224)
(AD-A029923; ONR-TR-18) Avail: NTIS HC A04/MF A01 CSCL 17/2

Several baseband adaptive communication systems are presented and analyzed with regard to 'self-synchronization' properties, intersymbol interference, and convergence properties. Recent convergence results, the proofs of which are contained in a companion report, are applied to provide extremely mild 'covariance decay-rate conditions' for which the algorithms treated converge with probability 1. Of special interest are the convergence results treating correlated cyclostationary training data. Recent results on maximum-likelihood sequence estimation are extended to treat the detection of general 'nonlinearly modulated' digital data over linear dispersive channels and nonwhite additive noise. Adaptive techniques for training the new detector structure are proppsed for use when the channel and/or the noise covariance function are unknown. Author (GRA)

N77-17349# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
EFFECTIVE ELECTROMAGNETIC PROPERTIES OF LOSSY FERRITE COMPOSITE MEDIA Final Report, Aug. 1973 - Aug. 1974
Karimpuzha S. Anathanarayanan Feb. 1976 70 p refs
(AF Proj. 7633)
(AD-A029931; AFAL-TR-75-91) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report discusses both the theoretical and experimental aspects of the problem of defining effective electromagnetic properties of non-homogeneous media. A simple theory has been developed for a one-dimensionally periodic medium containing lossy ferrite strips and the theory has been experimentally verified. This theory has been extended to two-dimensionally periodic media. An empirical theory has been applied to a composite medium composed of a honeycomb structure loaded with a lossy ferrite and experimentally verified. A computer program has been presented which is useful in solving the problem of one-dimensionally periodic media. The project is part of an ongoing program to develop new and efficient radar absorber materials. Author (GRA)

N77-17350# Mission Research Corp., Santa Barbara, Calif.
SCALING OF THE TIME DEPENDENT SGEMP BOUNDARY LAYER
C. L. Longmire and N. J. Carron Apr. 1976 19 p refs
(Contract DNA001-76-C-0086; DNA Proj. NWED-QAXEB069)
(AD-A029673; MRC-R-262; DNA-3975T) Avail: NTIS HC A02/MF A01 CSCL 20/9

The authors discuss the scaling laws for the time dependent behavior of the one dimensional SGEMP electron boundary layer. For an X-ray pulse that is constant in time or rises like any given power of time a single solution suffices for all fluxes. For a more realistic time history with a finite FWHM, the equations reduce to a single parameter family, the parameter being the ratio of the pulse FWHM to the characteristic plasma period. For the time behavior, the unit of time is taken as the FWHM. Both the scaled Boltzmann Equation and Newton's Equations are presented. GRA

N77-17265*# Texas Instruments, Inc., Dallas.
A SYNTHETIC APERTURE PROCESSOR USING CCD

SIGNAL PROCESSING TECHNIQUES
W. H. Bailey, M. S. Bergath, J. F. DuBose, W. L. Eversole, J. H. McGehee, R. V. Ridings, and D. C. Young *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 21-32 refs (For primary document see N77-17263 08-31)
(Contracts JPL-953954; JPL-954087; JPL-954340)
Avail: NTIS HC A11/MF A01 CSCL 17I

N77-17266*# Maryland Univ., College Park.
FOURIER ANALYSIS COMPUTER-AIDED DESIGN OF CCD SIGNAL PROCESSING ANALOG MULTIPLIER ARRAYS
H. C. Lin, D. R. Lampe (Westinghouse Electric Corp., Baltimore), M. H. White (Westinghouse Electric Corp., Baltimore), and I. A. Mack (Westinghouse Electric Corp., Baltimore) *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 33-44 refs (For primary document see N77-17263 08-31)
(Contract NAS1-13674)
Avail: NTIS HC A11/MF A01 CSCL 17B

N77-17268*# Santa Barbara Research Center, Goleta, Calif.
InSb ARRAYS WITH CCD READOUT FOR 1.0- TO 5.5-MICRONS INFRARED APPLICATIONS
J. D. Phillips, J. B. Scorso, and R. D. Thom *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 49-56 ref (For primary document see N77-17263 08-31)
(Contracts NAS1-13937; NAS1-14395)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-17280*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TELEVISION CAMERAS EMPLOYING SOLID-STATE IMAGING SENSORS FOR MANNED SPACECRAFT APPLICATIONS
Bernard C. Embrey, Jr. *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 126-128 (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 17B

N77-17285*# Fairchild Camera and Instrument Corp., Syosset, N.Y. Imaging Systems.
TELEVISION APPLICATIONS OF INTERLINE-TRANSFER CCD ARRAYS
Kenneth A. Hoagland *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 152-156 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-17351* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FREQUENCY MODULATED OSCILLATOR Patent
Martial A. Honnell, inventor (to NASA) (Auburn Univ., Ala.) Issued 11 Jan. 1977 5 p Filed 9 Apr. 1975 Supersedes N75-21518 (13 - 13, p 1499) Sponsored by NASA
(NASA-Case-MFS-23181-1; US-Patent-4,003,004; US-Patent-Appl-SN-566495; US-Patent-Class-332-30V; US-Patent-Class-331-114; US-Patent-Class-331-177V; US-Patent-Class-332-18) Avail: US Patent Office CSCL 09A

A frequency modulated push-pull oscillator in which the non-linear characteristic of varactors producing frequency modulation is compensated for by an opposite non-linear characteristic of a field effect transistor providing modulating bias to the varactors is described.

Official Gazette of the U.S. Patent Office

N77-17352 Virginia Univ., Charlottesville.
DESIGN OF DIRECT FREQUENCY SYNTHESIZERS Ph.D. Thesis
Alan David Wilcox 1976 204 p
Avail: Univ. Microfilms Order No. 76-22850

It is shown that a rate multiplier or a binary adder can be used to successfully fulfill these requirements if a frequency division is first performed on their outputs to reduce the phase jitter common to such devices. The phase jitter is described in the time domain, via algorithms, for both the rate multiplier and the binary adder; using computer analysis, it was found that this jitter decreased directly as the divisor increased. It is shown that the frequency domain phase noise also decreased directly as the divisor increased, and that the frequency domain phase noise over a limited bandwidth is directly proportional to the time domain jitter.

Dissert. Abstr.

N77-17353 Columbia Univ., New York.
PERIODIC SHAPING FILTERS FOR NONSTATIONARY RANDOM PROCESSES Ph.D. Thesis
Seyed Ali Ghozati 1976 139 p
Avail: Univ. Microfilms Order No. 76-29848

The main concern of the research is the determination of state-space equations of a linear periodic system, called a periodic shaping filter, that realizes a class of prescribed output covariance function. The synthesis of a periodic shaping filter provides a solution of the so-called factorization problem. It is shown that the output process of a stable periodic shaping filter whose input is a wide sense stationary random input process approaches a cyclostationary process. Moreover, a transformed state covariance matrix satisfying a matrix Riccati differential equation with periodic coefficients is derived from the given output covariance of the system. By use of a suitable transformation, the time interval of interest can be collapsed to one period. Thus the Riccati differential equation need be solved only over one period.

Dissert. Abstr.

N77-17354* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRONIC ANALOG DIVIDER Patent
Arthur G. Birchenough, inventor (to NASA) Issued 4 Jan. 1977 4 p Filed 24 Jul. 1975 Supersedes N75-28316 (13 - 19, p 2380)
(NASA-Case-LEW-11881-1; US-Patent-4,001,602; US-Patent-Appl-SN-598968; US-Patent-Class-307-229; US-Patent-Class-307-230; US-Patent-Class-328-161) Avail: US Patent Office CSCL 09C

Advantage is taken of the current-exponential voltage characteristic of a diode over a certain range whereby the incremental impedance across the diode is inversely proportional to the current through the diode. Accordingly, a divider circuit employs a bias current through the diode proportional to the desired denominator and applies an incremental current to the diode proportional to the numerator. The incremental voltage across the diode is proportional to the quotient.

Official Gazette of the U.S. Patent Office

N77-17355*# Bendix Corp., Teterboro, N.J. Flight Systems Div.
MULTI PURPOSE DISPLAY PANEL
12 Jul. 1976 21 p
(Contract NAS8-31286)
(NASA-CR-150155; FSD-7411-76-5) Avail: NTIS HC A02/MF A01 CSCL 09C

The multi purpose panel (MPP) project was undertaken to demonstrate the feasibility of producing a control signal which could be time shared among several subsystems and which would permit rapid and inexpensive modification of control panel functions. It is intended to bridge the gap between Multifunction Display Systems, which offer excellent display flexibility but present man-machine interface problems, and dedicated control panels, which offer no flexibility. A control panel was developed with programmable displays located near enough to control and display components to provide an acceptable man-machine interface.

Author

N77-17356*# Stanford Univ., Calif. Guidance and Control Lab.
ON THE APPLICABILITY OF INTEGRATED CIRCUIT TECHNOLOGY TO GENERAL AVIATION ORIENTATION

ESTIMATION Final Report
Daniel B. DeBra and Michael G. Tashker Dec. 1976 77 p refs
(Contract NAS2-9083)
(NASA-CR-151952) Avail: NTIS HC A05/MF A01 CSCL 09C

The criteria of the significant value of the panel instruments used in general aviation were examined and kinematic equations were added for comparison. An instrument survey was performed to establish the present state of the art in linear and angular accelerometers, pressure transducers, and magnetometers. A very preliminary evaluation was done of the computers available for data evaluation and estimator mechanization. The mathematical model of a light twin aircraft employed in the evaluation was documented, the results of the sensor survey and the results of the design studies were presented. Author

N77-17357*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF ELECTRICALLY PRE-STRESSING INSULATION TO PROVIDE DIRECTIONAL INCREASE IN dc POTENTIAL BREAKDOWN Patent Application
Irving G. Hansen, inventor (to NASA) Filed 31 Jan. 1977 7 p
(NASA-Case-LEW-12273-1; US-Patent-Appl-SN-764253) Avail: NTIS HC A02/MF A01 CSCL 09C

A method was provided for electrically pre-stressing an insulator to increase the dc breakdown strength of the insulator in a given direction. The method comprises placing an uncured, durable insulating material, such as an epoxy resin, in an electric field and curing the insulating material while maintaining the field so as to capture an electric field within the insulating material. The electric field biasses the breakdown potential in a given direction so that the insulation is able to withstand a substantially greater dc operating voltage of the appropriate polarity. NASA

N77-17358*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SWEPT GROUP DELAY MEASUREMENT Patent Application
David L. Trowbridge, inventor (to NASA) (JPL) Filed 24 Nov. 1976 14 p
(Contract NAS7-100)
(NASA-Case-NPO-13909-1; US-Patent-Appl-SN-744477) Avail: NTIS HC A02/MF A01 CSCL 09C

A method and apparatus for recording directly group delay measurement of a system under temperature and stress tests employing a modulated carrier frequency swept over an S or X band of interest is described and applied through a reference path and a test path to separate detectors for group delay measurement using a power divider, a directional coupler or a hybrid T junction. A phase comparator is initially balanced, and then the modulated carrier is swept in frequency over the band of interest for different conditions of temperature and/or mechanical stress to obtain a family of characteristics group delay curves for the system under test. NASA

N77-17359*# National Aeronautics and Space Administration. Pasadena Office, Calif.
OVERLAOD PROTECTION SYSTEM FOR POWER INVERTER Patent Application
Satoshi Nagano, inventor (to NASA) (JPL) Filed 15 Nov. 1976 18 p
(Contract NAS7-100)
(NASA-Case-NPO-13872-1; US-Patent-Appl-SN-742034) Avail: NTIS HC A02/MF A01 CSCL 09C

An overload protection system for a power inverter utilizes a first circuit for monitoring current to the load from the power inverter to detect an overload and a control circuit to shut off the power inverter when an overload condition is detected. At the same time a monitoring current inverter is turned on to deliver current to the load at a very low power level. A second circuit monitors current to the load from the monitoring current inverter to hold the power inverter off through the control circuit until the overload condition is cleared so the control circuit may be deactivated in order for the power inverter to be restored after the monitoring current inverter is turned off completely. NASA

N77-17360*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRAVELING WAVE TUBE CIRCUIT Patent Application
Denis J. Connolly, inventor (to NASA) Filed 15 Feb. 1977 12 p
(NASA-Case-LEW-12013-1; US-Patent-Appl-SN-768795) Avail: NTIS HC A02/MF A01 CSCL 09C

The traveling wave tube (TWT) has a slow wave structure (SWS) which is severed into two or more sections. A signal path connects the end of an SWS section to the beginning of the following SWS section. The signal path comprises an impedance matching coupler (IMC), followed by an isolater, a phase correcting filter, a variable phase shifter, and a second IMC. The aggregate band pass characteristic of the components in the signal path is chosen to reject, or strongly attenuate, all frequencies outside the desired operating frequency range of the TWT and yet pass with minimal attenuation in the forward direction, all frequencies within the desired operating frequency range. NASA

N77-17361# Sandia Labs., Albuquerque, N.Mex.
ELECTRICAL RESPONSES OF FERROELECTRIC CERAMICS TO DYNAMIC LOADS OF UNIAXIAL STRAIN
P. J. Chen, P. C. Lysne, and H. J. Sutherland 1976 8 p refs Presented at the ASME Symp. on the Propagation of Shock Waves in Solids, Salt Lake City, Utah, 14 Jun. 1976
(Contract AT(29-1)-789)
(SAND-76-5211; Conf-760605-2) Avail: NTIS HC A02/MF A01

The open circuit electrical responses of a dynamically loaded ferroelectric ceramic disc PZT 65/35 (Nb-doped PbZr0-65 Ti0-3403) was examined. The mechanical and electrical conditions of the physical problem are one dimensional. Presuming that the mechanical properties of the ceramic are known a priori, the recorded voltage histories are deduced. ERA

N77-17362# Sandia Labs., Albuquerque, N.Mex.
DRILL-LESS PRINTED WIRING BOARDS
T. A. Allen Apr. 1976 29 p refs
(Contract AT(29-1)-789)
(SAND-76-0174) Avail: NTIS HC A03/MF A01

Using a preformed substrate with 0.9 mm holes at every 2.54 mm junction and laying out the circuit to utilize this international grid spacing, printed circuit boards can be made with several standard processes at lower cost and with less capital equipment. Hole locating and drilling are eliminated and the system has built in registry. ERA

N77-17363# California Univ., Livermore. Lawrence Livermore Lab.
POCKELS CELL PULSE-STACKERS
R. C. Harney 7 Jan. 1976 11 p refs
(Contract W-7405-eng-48)
(UCRL-51908) Avail: NTIS HC A02/MF A01

The general transmission characteristics of a pulse stacking system consisting of an etalon and a cylindrical ring electrode Pockels cell Q-switch are discussed. A voltage pulse forming network capable of switching the Pockels cell transmission on the necessary time scales is presented, and the outputs of a single pulse-stacker configuration are calculated for different voltage waveforms. These results indicate that an efficient (approximately 1 percent total pulse energy transmission) Pockels cell pulse-stacker can be constructed, which can provide a variable, faster than exponential rise in transmitted pulse intensity. ERA

N77-17364# California Univ., Livermore. Lawrence Livermore Lab.
DERIVATION OF SIMPLE POLES IN A TRANSFER FUNCTION FROM REAL-FREQUENCY INFORMATION
J. N. Brittingham, E. K. Miller, and J. L. Willows 6 Apr. 1976 59 p refs Sponsored in part by ARPA
(Contract W-7405-eng-48)
(UCRL-52050) Avail: NTIS HC A04/MF A01

A new technique for extracting simple poles from real frequency transfer-function data is summarized. The effects of varying pole-set parameters are illustrated with computed results, and the technique is applied to the transfer function for field scattering by a straight wire. ERA

N77-17365# California Univ., Livermore. Lawrence Livermore Lab.

WF-SYR/LLL1: A THIN-WIRE COMPUTER CODE FOR ANTENNAS OR SCATTERERS WITH PULSE EXPANSION FUNCTIONS FOR CURRENT

R. M. Bevensee 18 Feb. 1976 49 p refs
(Contract W-7405-eng-48)
(UCRL-52028) Avail: NTIS HC A03/MF A01

The theoretical framework and the explanation of the WF-SYR/LLL1 code listing and a user's manual are given. The code solves for frequency domain currents and related quantities on wire structures or solid bodies modelled by grids of interconnected thin wires, acting either as antennas or scatterers. Essentially, the triangular testing functions were replaced by impulse functions at the wire segment centers, and the triangular expansion functions were replaced by pulse (rectangular) functions for current and by pulse doublets for charge. The basic method-of moments equations of the code are developed, including a charge redistribution scheme for multiple junctions. The code listing is explained as adapted to a cross wire. ERA

N77-17366# Sandia Labs., Albuquerque, N.Mex.

SAW DEVICES: DESCRIPTION AND COMPUTER MODELS

D. W. Palmer Mar. 1976 48 p refs
(Contract AT(29-1)-789)
(SAND-76-0017) Avail: NTIS HC A03/MF A01

A tutorial is presented on SAW device properties and applications, and several computer programs which model SAW device properties are listed. The usefulness of computer models in checking design and specification is demonstrated by comparison of the model predictions with rf measurements of SAW devices. The computer programs listed are in a format compatible with the in-house CDC 6600 computer using a SCOPE operating system along with the SC-4020 plotter. Author (ERA)

N77-17367# California Univ., Livermore. Lawrence Livermore Lab.

HIGH TEMPERATURE ELECTRONICS Status Report, 1974 - 1975

A. Blum 8 Apr. 1976 80 p refs
(Contract W-7405-eng-48)
(UCID-17109) Avail: NTIS HC A05/MF A01

The high temperature electronics program assembled and developed the technologies necessary for the fabrication of measurement and communications electronics operative in a 500 C ambient. The technology was developed to the level required to demonstrate medium scale integrated circuits. Basic electronic properties, structures, and fabrication technology for gallium phosphide and silicon carbide devices are presented. ERA

N77-17368# California Univ., Livermore. Lawrence Livermore Lab.

DESIGN OF YAGI ANTENNAS FOR A DOPPLER RADAR SYSTEM THAT MEASURES OCEAN SURFACE CURRENTS

J. L. Willows and R. J. Lytle Mar. 1976 66 p ref
(Contract W-7405-eng-48)
(UCID-17024) Avail: NTIS HC A04/MF A01

Numerical calculations made with the Lawrence Livermore Laboratory SWANT computer code were used to meet design criteria for Yagi antennas. The code was modified to include a gain calculation, to incorporate normalized field-pattern calculations, and to output the plots and summaries presented in the 62 figures included in the document. These antennas were designed for the National Oceanographic and Atmospheric Administration (NOAA) for use in its Doppler backscatter radar system that monitors the near-coastline ocean surface current. ERA

N77-17369# Oak Ridge National Lab., Tenn.

ORELA PERFORMANCE

T. A. Lewis Apr. 1976 12 p refs Sponsored by ERDA
(Contract W-7405-eng-26)
(ORNL/TM-5112) Avail: NTIS HC A02/MF A01

The most recent information concerning the performance of ORELA is presented. Characteristics of the beam in terms of both time and intensity and descriptions of systems routinely used to monitor these beam characteristics are included. With klystron power and maximum electron gun output current at nominal values and for pulse repetition rates in the range above 800 pps, output beam energies per pulse vary from 5 J for 2.5 nsec-wide pulses to approximately 32 J for 10 nsec pulses and 65 J for 40 nsec pulses. ERA

N77-17370# Sandia Labs., Albuquerque, N.Mex.

PROCESSES AND PROCEDURES FOR A THIN FILM MULTILEVEL HYBRID CIRCUIT METALLIZATION SYSTEM BASED ON W-Au/SiO2/Al/SiO2

R. E. Hampy, G. L. Knauss, E. E. Komarek, D. K. Kramer, and J. Villanueva Apr. 1976 38 p refs
(Contract AT(29-1)-789)
(SAND-76-0084) Avail: NTIS HC A03/MF A01

The processes and procedures developed for the deposition and photodefinition of a W-Au/SiO2/Al/SiO2 hybrid circuit metallization system for the SLL micro actuator are described. The metallization system affords a high degree of miniaturization and permits effective interconnection of a mixture of semiconductor devices and passive components with both gold and aluminum terminations without creating undesirable gold-aluminum interfaces. Sputtered tungsten-gold is the first level conductor and aluminum is the second level conductor. ERA

N77-17371# Institut Franco-Allemand de Recherches, St. Louis (France).

BEHAVIOUR OF NON LINEAR FERROELECTRIC CERAMICS UNDER SHOCK WAVES

F. Bauer and K. Vollrath 1 Dec. 1975 12 p refs Presented at the European Meeting on Ferroelec., Zurich, 22 Sep. 1975
(ISL-CO-216/75) Avail: NTIS HC A02/MF A01

The irreversible conversion of mechanical to electrical energy in ferroelectric ceramics of the Pb(Zr(1-x)Tix)O3 type with a considerable proportion of zirconium was studied. The depolarization of the ceramics was studied for shock compressions between 0 and 30 kbar. The maximum electrical energy obtained at about 18 kbar, is of the order of 1.8 J/cu cm with a Pb(Zr0.965Ti0.035) O3 + 1 % Nb2O5 and of the order of 0.8 J/cu cm with a Pb(Zr0.54Ti0.46)O3 + 1 % Nb2O5. Author (ESA)

N77-17372# AEG-Telefunken, Frankfurt am Main (West Germany). Bereich Forschung und Entwicklung.

NON-NUCLEAR ENERGY TECHNOLOGY. LOW TEMPERATURE CABLE FOR POWER TRANSMISSION Final Report

Hermann Franke, Ulrich Hildebrandt (Linde A. G.), Helmut Kuhmann (AEG-Telefunken Kabelwerke A. G.), Ernst Scheffler (Kabel- u. Metallwerke Gutehoffnungshuette A. G.), Heinz Voigt, and Eduard Bochenek Bonn Bundesmin. fuer Eorsch. u. Technol. Aug. 1976 226 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-196 (NT-4196A))
(BMFT-FB-T-76-01) Avail: NTIS HC A11/MF A01; ZLDI, Munich, DM 47.05

Cable components were developed for superconducting power transmission lines. Studies were carried out concerning design of a flexible contraction compensated dc cable, terminations, joints, and peripheral equipment. Test cables were manufactured and current-carrying capacity of the cable was tested in an experimental setup. Cable and terminations were installed for making high voltage tests. An energy-economic study was made. ESA

N77-17373# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands). Transmitting Tubes and Microwave Components Development Labs.

DESIGN OF A 800 WATT HIGH VOLTAGE POWER SUPPLY USING A RESONATING TRANSFORMER

R. C. vanderNet 7 Jan. 1976 104 p
(Contract ESTEC-2061/73-AK)
(ESA-CR(P)-861) Avail: NTIS HC A06/MF A01

The advantages of an advanced resonating transformer concept in the design of high power traveling wave tube converters were evaluated at circuit level. Critical circuits such as the transformer drive stage and the high voltage rectifiers were studied. A complete breadboard of an 800 watt 8000 volt TWT supply was assembled. This breadboard was then tested successfully. The scope was limited to the electrical evaluation of the circuits

developed. There was no attempt to adapt this design to space applications. Author (ESA)

N77-17374# Siemens A.G., Munich (West Germany). Werk Halbleiter.

GERMANIUM HIGH FREQUENCY TRANSISTORS IN PLANAR TECHNOLOGY Final Report

Wolfgang Mueller Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1976 49 p refs In GERMAN; ENGLISH summary

(Contract BMFT-NT-386)

(BMFT-FB-T-76-45) Avail: NTIS HC A03/MF A01; ZLDI, Munich, DM 10.30

Germanium pnp and npn high-frequency transistors in planar design were developed. In addition to standard diffusion and alloy techniques, mainly ion implantation techniques were used forming the emitter and base junction following basic experiments with arsenic, phosphorus, boron, and aluminum. Application of ion implantation requires an additional SiO2 layer. Base implanted pnp transistors yield results equal to diffused ones whereas implanting the emitter calls for an extra shallow base junction. Pnp-transistors with implanted base (As) and emitter (Al) show excellent dc and ac characteristics. In the case of npn's, however, where the base was boron and the emitter phosphorus implanted, the static parameters are very good while the dynamic values suffer somewhat from high base resistance. Author (ESA)

N77-17375# Siemens A.G., Munich (West Germany). Grundlagenentwicklung Halbleiter.

FUNCTIONING OF POWER RECTIFIERS AND THYRISTORS, PART 2 Final Report

Joachim Burtscher, Friedrich Dannhaeuser, Juergen Krausse, Helmut Strack, and Peter Voss Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1976 40 p refs In GERMAN; ENGLISH summary

(Contract BMFT-NT-70)

(BMFT-FB-T-76-51) Avail: NTIS HC A03/MF A01; ZLDI, Munich, DM 8.40

The influence of the recombination properties of the different silicon layers in power rectifiers and thyristors of the forward characteristic and the dynamic behavior is discussed quantitatively, taking into account Auger recombination. This leads to more exact dimensioning guidelines for the development of technical devices. A scaling down of the arrangement of the shorts in shorted emitters of thyristors improves the dv/dt capability and recovery time, but leads to an impaired plasma spreading. The conditions needed to avoid current channeling at thyristor turn-on were investigated. A thyristor that can be ignited by exceeding its breakover voltage was developed, as well as a thyristor for 10 kHz applications and a thyristor that turns on without current channeling. Insight into the processes taking place inside power rectifiers during commutation was gained with a simple theoretical model. Author (ESA)

N77-17376# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.

ANNEALING RELATED DEFECTS IN GALLIUM ARSENIDE

Mark Stuart Durschlag Jul. 1976 50 p refs

(Contract DAAB07-72-C-0259)

(AD-A028801; R-732; UILU-ENG-76-2220) Avail: NTIS HC A03/MF A01 CSCL 20/12

In recent years, interest in the binary and ternary compound semiconductors has grown considerably. The thermal diffusion of impurities, which is a basic process of silicon technology, is much more limited in the compound semiconductors. The effect of thermal dissociation in GaAs, a widely used binary semiconductor, and the difficulties in doping which ensue because of it, have provided the motivation for this work. Low temperature photoluminescence is employed in an effort to more fully understand the nature of the defects generated by annealing. With the insight gained in this manner, a tentative solution to the problem is proposed and evaluated. GRA

N77-17377# IRT Corp., San Diego, Calif.

RADIATION EFFECTS IN SEMICONDUCTOR AND INSULATOR MATERIALS Final Report

Roland E. Leadon, Donald P. Snowden, and Jason M. Wilkenfield Apr. 1976 165 p refs

(Contract DAAG39-75-C-0152)

(AD-A027779; INTEL-RT-8124-004; HDL-CR-76-152-1) Avail: NTIS HC A08/MF A01 CSCL 20/12

The generation, recombination, trapping, and transport of carriers in the oxide (SiO2) of MOS devices has been investigated theoretically and experimentally. Calculated charge transfer and gate threshold shifts have been compared to experimental data for Shockley-Read, geminate, and columnar recombination. Columnar recombination agrees best with both low-energy electron and (60)Co irradiations. Time histories and total charge transfer were obtained for short pulses of 30-MeV electrons as a function of bias. The charge transfer versus bias differs significantly for two different sets of devices. The radiation and thermal depolarization of persistent internal fields created in polymer films by burn-in was studied. The data suggest that the creation of stable space-charge fields depends on (1) the existence of trapping sites associated with specific morphological features of each polymer or (2) on the alignment of molecular dipoles. GRA

N77-17378# Princeton Univ., N.J. Dept. of Electrical Engineering.

STUDY OF ELECTRONIC TRANSPORT AND BREAKDOWN IN THIN INSULATING FILMS Final Report, 1 Jul. 1972 - 30 Nov. 1975

Walter C. Johnson Griffiss AFB, N. Y. RADC May 1976 48 p refs

(Contract F19628-72-C-0298; ARPA Order 2180; AF Proj. 5621)

(AD-A029241; RADC-TR-76-158) Avail: NTIS HC A03/MF A01 CSCL 11/7

This report summarizes the results obtained in a research program directed toward a basic understanding of electronic transport, charge trapping, and dielectric breakdown in thin (500-3,000 A) silicon dioxide films thermally grown on silicon substrates. The research techniques that we have developed and utilized are applicable to other insulating films, but up to this time we have concentrated on the properties of thermally grown SiO2 films because of the importance of the Si/SiO2 in modern solid-state circuits. The program consisted of a number of coordinated investigations which included studies of charge injection, transport, and trapping in which the injection of charge carriers into the insulator was induced by corona charging of the surface of the insulator, the study of the instability at the onset of breakdown and of catastropic breakdown itself by the self-quenching technique, the probing of trapping centers in the insulating film by charge-discharge techniques using equipment which we developed especially for this purpose, studies of charge transport and trapping using an electron beam for carrier injection, studies of lateral nonuniformities in MIS structures by electrical measurement techniques and by use of a scanning electron microscope, and theoretical modeling of hot-electron transport and of localized breakdown. GRA

N77-17379# Northrop Corp., Des Plaines, Ill.

LOW COST CROSSED-FIELD AMPLIFIER Interim Technical Report, 10 Jun. 1975 - 31 Mar. 1976

R. R. Moats Jun. 1976 44 p refs

(Contract DAAB07-75-C-1343; DA Proj. 1S7-62705-AH-94)

(AD-A028252; ECOM-75-1343-1) Avail: NTIS HC A03/MF A01 CSCL 09/5

This work is directed toward the achievement of a lower cost slow-wave structure for an injected-beam crossed-field amplifier (IBCFA) than has heretofore been possible. For cost reduction, the meander type of structure is to be supported on an ECOM design shaped dielectric substrate instead of individual insulator bars. The slow-wave structure designed and built simulates the configuration of the shaped substrate, but is built using conventional technology. In other respects, the design of the tube is similar to a production line IBCFA. Performance of the first experimental model is considered, in general, representative of the capability of this design. Power output of more than 3 kW peak and over 30% efficiency was achieved in the middle of the 2-4 GHz band, measured with 20 dB gain. Performance in the lower half of the band degraded slowly as frequency was reduced below 2.6 GHz, and degraded more rapidly as frequency was increased above 3.4 GHz. Substantial power and efficiency increases were observed for increased drive, indicating that a longer interaction space is desirable. Efficiency levels not far different from those at 3kW peak power output

were observed at 1 kW, 2 kW and 4 kW peak power output by adjusting the magnetic field and the applied voltages.
Author (GRA)

N77-17380# Cornell Univ., Ithaca, N.Y. School of Applied and Engineering Physics.
PERFORMANCE FACTORS IN rf SQUIDS - HIGH FREQUENCY LIMIT
R. A. Buhrman and L. D. Jackel 17 Aug. 1976 5 p refs
(Contract N00014-76-C-0526; NR Proj. 319-096)
(AD-A029229; TR-3) Avail: NTIS HC A02/MF A01 CSCL 20/3

The mode of operation of rf SQUIDs in the limit where the bias frequency Omega exceeds the natural R/L frequency of the SQUID ring is analyzed. Optimum coupling conditions are presented and the intrinsic noise limits are discussed.
Author (GRA)

N77-17381# Sandia Labs., Albuquerque, N.Mex.
ELECTRICAL PROPERTIES OF PRINTED WIRING BOARDS
Charles W. Jennings May 1976 61 p refs
(Contract AT(29-1)-789)
(SAND-75-0663) Avail: NTIS HC A04/MF A01

Test results are displayed graphically and tabulated for Sandia/Bendix standard process boards: voltage holdoff, current carrying capacity and insulation resistance for double sided bare, coated and encapsulated boards. The boards were fabricated by a panel plating process and contain variable conductor widths and separations. Current carrying capability of conductors was evaluated from the temperature rise generated with step increases in current. Variations in temperature rise between conductors with the same nominal or design width were correlated with measured differences in conductor cross sectional areas. ERA

N77-17382# Naval Research Lab., Washington, D.C.
COMPUTER-AIDED ANALYSIS OF DISSIPATION LOSSES IN ISOLATED AND COUPLED TRANSMISSION LINES FOR MICROWAVE AND MILLIMETER-WAVE INTEGRATED-CIRCUIT APPLICATIONS Interim Report
Barry E. Spielman Jul. 1976 98 p refs
(RR0210346; NR Proj. R08-820)
(AD-A029211; NRL-8009) Avail: NTIS HC A05/MF A01 CSCL 09/5

The analysis employs a quasi-TEM model for uniform isolated transmission lines and for the even and odd-mode transmission lines associated with coupled-line structures. The conductor and dielectric losses in these structures are then related to equivalent charge-density distributions, which are evaluated using a method-of-moments solution. The transmission lines treated by this which are evaluated using a method-of-moments solution. The transmission lines treated by this analysis may contain any number of lossy conductors and inhomogeneous dielectrics, consisting of any number of different homogeneous dielectric regions. After explicit expressions are developed for use in evaluating conductor and dielectric loss coefficients for the even and odd modes of coupled transmission lines a development is provided to explicitly relate the four-port, terminal, electrical performance of directional couplers to the modal loss coefficients. Losses are evaluated for examples of four isolated transmission lines and one coupled transmission line. For microstrip and coplanar waveguide the computed loss coefficients are in reasonable agreement with experimental data. For inverted microstrip and trapped inverted microstrip, evaluations presented in both tables and graphs provide useful design information for circuit applications. A comparison is made of the total loss characteristics of microstrip, coplanar waveguide, inverted microstrip, and trapped inverted microstrip. The utility of the analysis for coupled-transmission-line losses is illustrated for the example of edge-coupled microstrip with a dielectric overlay by comparing computed loss characteristics with measured values.
GRA

N77-17383# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
INTEGRATED CIRCUIT ELECTROMAGNETIC SUSCEPTIBILITY INVESTIGATION - PHASE 3, IC SUSCEPTIBILITY HANDBOOK - DRAFT 1
J. M. Roe 4 Jun. 1976 99 p refs
(Contract N60921-76-C-A030; XF54585001)
(AD-A029224; MDC-E1515; NSWC/DL-TR-3506) Avail: NTIS HC A05/MF A01 CSCL 09/5

The objective of this handbook is to provide system designers with integrated circuit (IC) susceptibility information in terms of microwave signals. This is the first draft of the IC Handbook for comments from eventual users. The data in the handbook include interference susceptibility from testing and modeling, degradation from testing, and catastrophic failure from testing. Both digital and linear ICs are covered in the handbook. This version includes all data available at the end of the first of three increments of the susceptibility investigation. The handbook explains the electromagnetic vulnerability (EMV) hardening approach for electronic systems. On the component level susceptibility reduction techniques such as use of lossy ferrite materials and screening for less susceptible devices are included. This handbook will provide designers with actual test data when available and modeling techniques to determine susceptibility information when no test data are available.
Author (GRA)

N77-17384# K and M Electronics, Springfield, Mass.
CYCLOPS POWER SUPPLY (TYPE B) Final Report, 25 Jul. 1975 - 30 May 1976
James L. Knak 30 Jun. 1976 49 p refs
(Contract DAAG53-76-C-0006)
(AD-A029232; Rept-1011) Avail: NTIS HC A03/MF A01 CSCL 09/5

The work performed under contract DAAG53-76-C-0006 has resulted in a power supply design which can be manufactured at a cost considerably less than present goggle tube power supplies. Several design approaches were evaluated to establish the lowest cost without sacrificing required performance. GRA

N77-17385# Hughes Aircraft Co., Culver City, Calif. Radar Microwave Lab.
PHASED ARRAY ANTENNAS SCANNED NEAR ENDFIRE Final Report, Jan. 1975 - Mar. 1976
P. C. Bargeliotes, A. T. Villeneuve, and W. H. Kummer Mar. 1976 57 p refs
(Contract N00019-75-C-0160)
(AD-A028781; HAC-P76-232; HAC-Ref-D3119) Avail: NTIS HC A04/MF A01 CSCL 09/5

Excellent agreement has been shown between element patterns of circumferential and radial slots on a cone, computed with the normal mode series computer programs, and patterns measured with an experimental model with both types of slots. When the modal series is used for the computation of exact patterns, the number of modes required for convergence of the series increases as the distance of the slot location from the tip of the cone increases. Computational difficulties from accumulated round-off errors also affect the accuracy and limit the applicability of the modal series program to element positions not too far from the cone tip. The approximate asymptotic approach, on the other hand, allows the separation of the diffracted field and the geometrical optics field. More specifically, the asymptotic approach resulted in complete expressions for the E sub theta and E sub phi radiation fields in terms of optical, transition, and diffraction fields. The complete expressions for each of the two field components, in a form suitable for numerical computation, were included in the Final Report on Contract No. N00019-74-C-0127. An examination of these expressions indicates that the diffraction coefficients of both field components are only a function of the angular coordinates and not of the location of the radiating element.
GRA

N77-17386# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
MILLIMETER DUAL HELIX TRAVELING-WAVE TUBE Final Report, 1 Jul. 1975 - 30 Jul. 1976
A. E. Manoly Aug. 1976 56 p
(Contract DAAB07-75-C-1368; DA Proj. 1S7-62705-AH-94)
(AD-A029234; EDD-W-06596-F; ECOM-75-1368-F) Avail: NTIS HC A04/MF A01 CSCL 09/5

Results of the dual beam electron gun design studies have been incorporated into a reliable production type gun structure. The fixturing produced close tolerances needed for the small gun sizes. The size to length ratio caused severe broaching

problems. These problems were solved by fabricating the barrel sections by milling, brazing and final machining. Deformation of the barrel, resulting from the final sizing broach operation, was eliminated by special fixtures. The use of a stripline in conjunction with a two section quarter wave transformer has produced a good match over the band. Two experimental Ku-band traveling-wave tubes have been built and evaluated. The evaluations indicate the limitations of this design. Author (GRA)

N77-17387# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
THE 16 INPUT/1 OUTPUT SWITCHING MATRICES
D. Penunuri 22 Jan. 1976 70 p ref
(Contract F19628-75-C-0175; AF Proj. 634B)
(AD-A028730; C75-518/501; Scientific-1; AFGL-TR-77-0016)
Avail: NTIS HC A04/MF A01 CSCL 09/5

The design, fabrication, and performance of a 16 input/1 output UHF switch matrix is described. Each switch is a combination of silicon-on-sapphire PIN diodes, operates in the frequency range 950-1220 MHz, provides a 50 dB on-off ratio, and switches in less than 2 nsec. The switch array is compatible with high frequency (about 1 GHz), surface acoustic wave filter banks. GRA

N77-17388# TRW, Inc., Lawndale, Calif. Semiconductor Div.
PRODUCTION ENGINEERING MEASURE FOR AN INTEGRATED CIRCUIT POWER AMPLIFIER 600-1000 MHz, FOR TACTICAL RADIO EQUIPMENT Quarterly Report, 1 Apr. - 30 Jun. 1976
Roger C. DeBloois Jun. 1976 65 p
(Contract DAAB05-72-C-5844)
(AD-A030510 ; QR-17) Avail: NTIS HC A04/MF A01 CSCL 17/2

This quarter was spent in preparing for pilot production of the fifty amplifiers. Component parts were ordered or fabricated, production tests and life test equipment was assembled and tested, and production documentation corrected. Author (GRA)

N77-17264*# ITT Electro-Physics Labs., Inc., Columbia, Md. Avionics Div.
CCD FILTER AND TRANSFORM TECHNIQUES FOR INTERFERENCE EXCISION
G. M. Borsuk and R. N. DeWitt *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 1-20 refs (For primary document see N77-17263 08-31)
(Contract N00014-76-C-0496)
Avail: NTIS HC A11/MF A01 CSCL 09A

N77-17267*# Aerospace Corp., El Segundo, Calif.
METAL-INSULATOR-SEMI-CONDUCTOR STUDIES OF LEAD TELLURIDE
D. A. Lilly, D. E. Joslin, and H. K. A. Kan *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 45-48 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 09C

N77-17273*# Rockwell International Corp., Anaheim, Calif. Electronics Res. Div.
A SUB-NANOSECOND CCD
Y. T. Chan *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 89-94 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 09C

N77-17278*# California Univ., Livermore. Lawrence Livermore Lab.
A CCD INTEGRATED CIRCUIT FOR TRANSIENT RECORDERS
Joseph W. Balch and Charles F. McConaghy *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 115-119 refs (For primary document see N77-17263 08-31)
(Contract W-7405-eng-48)
Avail: NTIS HC A11/MF A01 CSCL 09A

N77-17287*# Naval Postgraduate School, Monterey, Calif.
THEORY AND APPLICATIONS OF SAMPLED ANALOG RECURSIVE CTD COMB FILTERS
T. F. Tao, S. Holmes, A. Ejaz, F. Piazza, L. Saetre, and B. Freund *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 10 p refs Sponsored in part by Naval Electronic Systems Command (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 09A

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N77-17389 Miami Univ., Coral Gables, Fla.
A STOCHASTIC MODEL OF A STRATIFIED FLUID Ph.D. Thesis
Sylvia Jean Worthem 1976 140 p
Avail: Univ. Microfilms Order No. 77-786

A fluid model which simulates a flow having variable shear and stability was formulated in order to investigate the response of the upper ocean, where wind stress and buoyancy forces are both forcing mechanisms. The model is stochastic and utilizes a modified Monte Carlo approach. The model fluid consists of an ensemble of fluid parcels which move in and interact both dynamically and thermodynamically with a continuous mean field through binary elastic collision type interactions. The model in its present form is applicable when the Monin-Oboukhov length is the controlling scale. Numerical experiments with the mean field prescribed give a vertical diffusivity stability dependence which is comparable with other models. Dissert. Abstr.

N77-17390*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPERIMENTAL STUDY OF REACTIVE TURBULENT MIXING
L. P. Cooper, C. J. Marek, and R. A. Strehlow 1977 31 p refs Presented at 15th Aerospace Sci. Meeting, Los Angeles, 24-26 Jan. 1977; sponsored by AIAA
(NASA-TM-X-73579; E-9041) Avail: NTIS HC A03/MF A01 CSCL 20D

An experimental study of two coaxial gas streams, which react very rapidly, was performed to investigate the mixing characteristics of turbulent flow fields. The center stream consisted of a CO-N2 mixture and the outer annular stream consisted of air vitiated by H2 combustion. The streams were at equal velocity (50 m/sec) and temperature (1280 K). Turbulence measurements were obtained using hot film anemometry. A sampling probe was used to obtain time averaged gas compositions. Six different turbulence generators were placed in the annular passage to alter the flow field mixing characteristics. The turbulence generators affected the bulk mixing of the streams and the extent of CO conversion to different degrees. The effects can be related to the average eddy size (integral scale) and the bulk mixing. Higher extents of conversion of CO to CO2 were found be increasing the bulk mixing and decreasing the average eddy size. Author

N77-17391*# Kanner (Leo) Associates, Redwood City, Calif.
INVESTIGATION OF HEAT TRANSFER AND RESISTANCE FOR GAS FLOWS IN A RECTANGULAR CHANNEL WITH AN ISOLATED RIB
Z. V. Tishchenko and N. D. Butskiy Washington NASA Feb. 1977 9 p refs Transl. into ENGLISH from Teplofizika i Teplotekhnika (USSR), no. 30, 1976 p 100-103
(Contract NASw-2790)
(NASA-TT-F-17359) Avail: NTIS HC A02/MF A01 CSCL 20D

Wind tunnel studies of heat transfer and resistance of air flow in a rectangular channel with longitudinal ribs of various types (smooth, punched slots, slit with tapered rib elements, mesh) were made. It was found that turbulators on a longitudinal rib were better than tubulators on the channel wall, in that they increase heat transfer with a moderate increase in hydraulic resistance by effects on the stagnant corner zones. Author

N77-17392# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

A NONLINEAR STABILITY THEORY FOR TWO-DIMENSIONAL DISTURBANCES IN PLANE PARALLEL FLOWS

Motoyoshi Ikeda Jul. 1976 28 p refs

(ISAS-543) Avail: NTIS HC A03/MF A01

By use of a Fourier transform and an expansion in power series of disturbance amplitude, a momentum equation is reduced to a non-linear parabolic differential equation for the disturbance amplitude. Non-linear effects are considered to the third order of the amplitude. Disturbance energy is assumed to be concentrated in the most dangerous modes, which have wave numbers close to the wave-number corresponding to the largest temporal growing rate selected stability theory. It is explained that the disturbance energy must be distributed within the very narrow range of the wave-number for obtaining the amplitude equation. The amplitude equation is similar to the equation already known, though the equation in this analysis has the interactions between low wave-number modes and the most dangerous modes. For the subcritical case, the unstable equilibrium amplitude is examined by means of numerical calculations. Author

N77-17393# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

A STUDY OF TRANSIENT THERMAL RESPONSE OF ABLATION MATERIALS

Norio Arai Sep. 1976 34 p refs Repr. from ISAS Rept. 544 (Japan), v. 41, no. 8, Sep. 1976

(ISAS-544) Avail: NTIS HC A03/MF A01

A thermal analysis for transient response of ablating materials made of high molecular compounds is developed on the basis of the two-layer thermal model by the use of an appropriate numerical method. The assumptions of quasi-steady boundary layer flow and the equilibrium vaporization at the ablating surface are employed. Numerical computation was carried for an ablating blunt body of revolution made of Teflon with an emphasis laid on the effect of the second-order transition-i.e., the gel layer. The transient internal temperature near the ablating surface was diminished considerably by the existence of the gel layer. Comparison of the numerical results with the experimental data reveals that the single-layer thermal model does not predict the real feature of the transient thermal field, while the two-layer thermal model agrees well with the experiment, thus confirming the validity of the present approach. Author

N77-17394*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

AN INVESTIGATION OF VISCOUS LOSSES IN RADIAL INFLOW TURBINE NOZZLES Interim Report

I. Khalil, W. Tabakoff, and A. Hamed [1977] 87 p refs Sponsored in part by US Army Air Mobility Res. and Development Lab., Moffett Field, Calif.

(Contract NAS2-7850)

(NASA-CR-137942) Avail: NTIS HC A05/MF A01 CSCL 20D

A theoretical model is developed to predict losses in radial inflow turbine nozzles. The analysis is presented in two parts. The first one evaluates the losses which occur across the vaned region of the nozzle, while the second part deals with the losses which take place in the vaneless field. It is concluded that the losses in a radial nozzle would not be greatly affected by the addition of a large vaneless space. Author

N77-17395*# Lamont-Doherty Geological Observatory, Palisades, N.Y.

MODELING STUDIES FOR A MARS PENETRATOR HEAT FLOW MEASUREMENT

Stephen J. Keihm and Marcus G. Langseth [1976] 29 p

(NASA Order A-35054-B)

(NASA-CR-151946; TR-CU-1-77) Avail: NTIS HC A03/MF A01 CSCL 20D

There were, two different design concepts considered for the purpose of measuring heat flow as part of a Mars penetrator mission. The first of the tentative designs utilizes temperature sensors emplaced along the trailing umbilicus at regularly spaced intervals, no greater than 1m, which is thermally coupled to the adjacent regolith radiatively and possibly convectively or conductively. The second of the heat flow designs considered requires the radial deployment of two or more low thermal mass temperature sensors outward from the penetrator body over a vertical (depth) range on the order of 1m. Author

N77-17396# Aeronutronic Ford Corp., Newport Beach, Calif.

LINEARIZED THEORY OF GAS-DYNAMIC-LASER NOZZLE WAKES AND APPLICATIONS Interim Report

Anthony Demetriades Oct. 1976 68 p refs Backup document for AIAA Synoptic, "Linearized Analysis of Gas-Dynamic-Laser Wakes with Applications", scheduled for publication in Journal of Energy, March-April 1977

(Contract F44620-75-C-0016; AF Proj. 9781)

(U-6276) Avail: NTIS HC A04/MF A01

Equations describing the development of wakes trailing from gas-dynamic-laser nozzle cusps are assembled in compact form. A particular family of appropriately short, geometrically similar DeLaval nozzles is considered. The exit flow is assumed parallel, and the trailing edge thickness is taken to be sharp. Fully laminar and fully turbulent wakes are considered for arbitrary exit Mach and Reynolds number, specific heat ratio and nozzle-to-stagnation temperature ratio. The total viscous drag and heat exchanged with the nozzle cusp are calculated, for such conditions, for both laminar and turbulent nozzle boundary layer. To calculate the laminar wake, Kubota's linearized similarity theory is then utilized; for the turbulent wake an analogous similarity theory is used, with key information on turbulent transport drawn from recent two-dimensional supersonic wake experiments. Procedures are indicated, and charts and tables are supplied for applying the formulas to any set of design parameters. A specific example at Mach 4 is computed in detail. Author

N77-17397# Technische Hogeschool, Delft (Netherlands).

A NOTE ON THE CENTRIFUGAL SCALING OF HORIZONTAL ISOTHERMAL, LIQUID-GAS FLOWS WITHOUT MASS TRANSFER

A. K. Chesters Aug. 1976 15 p refs Submitted for publication

(WTHD-89) Avail: NTIS HC A02/MF A01

The use of rotation to simulate increased gravity in scale models of horizontal liquid-gass flows is examined. The influences of Coriolis forces and natural gravity in the model are seen to be small provided high rotation rates are used, and large length scale-down factors can then be achieved. The modelling of compressibility and gas viscosity effects, however, is not normally possible and these must therefore be small in the original flow.

N77-17398# Lockheed Missiles and Space Co., Palo Alto, Calif.

SELECTION OF THE CHARACTERISTICS OF SEMI-OPAQUE POROUS MATERIALS IN HEAT-STRESSED STRUCTURE ELEMENTS

V. A. Tovstonog and S. V. Reznik [1976] 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (USSR), no. 10, 1956 p 90-93

Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

An analysis is performed of the temperature fields, transmissivity and reflexivity of walls from absorbing and dissipating materials for porous cooling. In connection with the use of semi-opaque materials with a complex structural configuration (ceramics, sitalles, porous glasses) in heat-stressed structure elements, methods are postulated to compute their thermal state which would permit connecting the structural characteristics and properties of the materials to regularities of heat exchange. Author

N77-17399# National Aeronautical Establishment, Ottawa (Ontario). High Speed Aerodynamics Lab.

THREE-DIMENSIONAL SWEPT SHOCK/TURBULENT BOUNDARY-LAYER SEPARATIONS WITH CONTROL BY AIR INJECTION

D. J. Peake Jul. 1976 230 p refs

(LR-592; NRC-1557; ISSN-0077-5541) Avail: NTIS HC A11/MF A01

Experimentally determined wall pressure distributions, local surface shear stresses and their directions, and detailed turbulent boundary layer traverses in near zero heat transfer conditions, are presented through skewed shock/boundary layer interaction

regions generated by a wedge standing normal to a test wall. The mainstream Mach numbers were 2 and 4, while the Reynolds number based on the undisturbed test boundary layer thickness of 0.2-in., growing along the nozzle sidewall of the NAE 5 x 5-in. blowdown wind tunnel, was approximately 200,000. Tangential air injection at a jet exit Mach number of 3 was then introduced into the 3D shock separated Mach 2 boundary layer, to control the separation. The optimum direction of blowing was found to be along a line somewhere between the deflected surface of the wedge and the line of the oblique shock wave. Author

N77-17400*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A COMPARISON OF IMPLICIT NUMERICAL METHODS FOR SOLVING THE TRANSIENT SPHERICAL DIFFUSION EQUATION
Donald M. Curry Jan. 1977 39 p refs
(NASA-TM-X-58194; JSC-11628) Avail: NTIS HC A03/MF A01 CSCL 20D

Comparative numerical temperature results obtained by using two implicit finite difference procedures for the solution of the transient diffusion equation in spherical coordinates are presented. The validity and accuracy of these solutions are demonstrated by comparison with exact analytical solutions. Author

N77-17401*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SILICA HEAT SHIELD SIZING Final Report, 4 Mar. - 24 Jul. 1975
L. H. Ebbesmeyer and H. E. Christensen 24 Jul. 1975 125 p refs
(Contract NAS2-7897)
(NASA-CR-151962; MDC-E1343) Avail: NTIS HC A06/MF A01 CSCL 20D

The sensitivity of silica heat shield requirements to gap width, tile edge radius, and heat transfer distribution within tile gaps was investigated. A two-dimensional thermal model was modified and used to determine the effect of two dimensional heat transfer distributions at high temperature reusable surface insulation edges on shuttle thermal protection system (TPS) requirements. The sensitivity of TPS requirements to coating thickness, emissivity, substructure thickness, and changes in gap heating for several locations on shuttle was also studied. An inverse solution technique was applied to temperature data obtained in the Ames 20 MW turbulent duct in order to examine the effect of tile edge radius on TPS requirements. The derived heating values were then used to predict TPS requirements. Results show that increasing tile radius reduces TPS requirements. Author

N77-17402# Lockheed Missiles and Space Co., Palo Alto, Calif.
MODELING THE INTERACTION BETWEEN MOLECULES OF THE ATMOSPHERE AND THE SPACE VEHICLE SURFACE
G. I. Petrov, ed. [1976] 3 p Transl. into ENGLISH from the book "Modelirovaniye Teplovykh Rezhimov Kosmicheskogo Apparata is Okruzhaiushchei ego Sredy" Moscow, Mashinostroenie Press, 1971 p 188-191
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The main difficulty in determining the energy liberated during interaction between the space vehicle surfaces and the molecules and atoms of the upper atmosphere was determining the coefficient of thermal accommodation. This coefficient was a complex function of the particle velocity, the wall temperature, the ratio between the molecular weights of the wall material and the gas, the roughness, and the presence of adsorbed layers of gas molecules and atoms on the body surface. Author

N77-17403# Ames Lab., Iowa.
PREDICTION OF TRANSPORT PROPERTIES OF GASES USING CLASSICAL NONSPHERICAL MODELS Ph.D. Thesis - Iowa State Univ.
Jerome Daniel Verlin Jan. 1976 191 p refs
(Contract W-7405-eng-82)
(IS-T-701) Avail: NTIS HC A09/MF A01

The parameters of the model are optimized and are found to assume physically reasonable values. The calculations agree with experiment to a degree comparable to that of similar work on diatomic molecules. A generalized scattering cross section, gamma, is defined which can be evaluated exactly for the limiting cases of a spherical soft potential and rigid ovaloids. For a general soft nonspherical interaction of the Kihara type, a suitable approximation for the momentum dependence is made with the following attributes: gamma reduces to the form for soft sphere and rigid ovaloid in the limits and the resulting matrix elements of the collision operator can be written in terms of the familiar omega (asterisk) integrals. ERA

N77-17404# Ames Lab., Iowa.
CALCULATION OF THE SECOND VIRIAL COEFFICIENT FOR DIPOLAR AND QUADRUPOLAR POLYATOMIC GASES Ph.D. Thesis - Iowa State Univ.
Harry Alan Burns Jan. 1976 88 p refs
(Contract W-7405-eng-82)
(IS-T-703) Avail: NTIS HC A05/MF A01

The classical statistical mechanical development of the equation of state for polyatomic gases was reviewed and a historical background of work of interest to the present study was given. Equations for the second virial coefficient for dipolar and quadrupolar gases are derived from an assumed model of interaction. The model consists of two rigid cores interacting via a soft potential which is a sum of valence repulsion, dispersion, and electrostatic interaction potentials and which is parameterized by the shortest distance between the hard cores. This parameterization is accomplished by expanding the electrostatic potential about multipole centers which float on the surfaces of the hard cores, and by assuming the valence repulsion and dispersion potentials to be of a Kihara type. Author (ERA)

N77-17405# Oak Ridge Gaseous Diffusion Plant, Tenn.
USER'S GUIDE FOR SHFA: STEADY-STATE HEAT FLOW ANALYSIS OF TEE JOINTS BY THE FINITE ELEMENT METHOD
R. E. Textor Jan. 1976 22 p refs
(Contract W-7405-eng-26)
(UCCND-CSD-INF-60) Avail: NTIS HC A02/MF A01

The program SHFA (Steady-State Heat Flow Analysis) determines the steady-state temperature distribution in pipe tee joints. Temperatures are specified on given cross-sections of the branch and run portions of the tee joint, and the temperature distribution throughout the remainder of the joint is calculated under the assumption that the inner and outer surfaces are perfectly insulated. The output of the program includes information suitable for thermal stress analysis. ERA

N77-17406# Colorado State Univ., Fort Collins.
FLUXES OF TRACERS IN WIND AND WATER TUNNELS Final Report
J. Gessler Mar. 1976 43 p
(Contract E(11-1)-1813)
(COO-1813-5) Avail: NTIS HC A03/MF A01

The absorption process of particulate matter at an air-water interface was studied by means of a Monte Carlo simulation. This absorption process was not significantly different from similar processes over stationary boundaries. Especially an increased flux toward the boundary as the result of more effective particle removal due to wave action was not observed. The particular nature of the tracer prevented this from happending. ERA

N77-17407# Institut Franco-Allemand de Recherches, St. Louis (France).
CALCULATION OF A QUASI ONE-DIMENSIONAL GAS FLOW IN EQUILIBRIUM OR NOT. COMPARISON OF THE RESULTS AND APPLICATION TO A HYPERSONIC WAKE [CALCUL D'UN ECOULEMENT QUASI MONODIMENSIONNEL D'UN GAZ EN EQUILIBRE OU NON. COMPARAISON DES RESULTATS ET APPLICATION AU SILLAGE HYPERSONIQUE]
B. C. Jaeggy 8 Jul. 1975 94 p refs In FRENCH
(ISL-R-128/75) Avail: NTIS HC A05/MF A01

The flow around a hypersonic body is represented by the following one-dimensional model: equilibrium gas flow with constant cross section, straight shock, sudden expansion of the equilibrium frozen gas, and new gas flow equilibrium with constant cross section. The equations applied to this problem, as well as the numerical solution methods, are described (including a computer program). Some results are reported, especially on the

effect of the final cross section under given initial conditions. The results are also compared to those obtained by a more elaborate calculation of the wake taking into account reaction kinetics. ESA

N77-17408# Eidgenoessisches Flugzeugwerk, Emmen (Switzerland). Research and Testing Dept.

STUDY OF FLUID LOOP SYSTEMS FOR USE IN SPACECRAFT THERMAL CONTROL Final Report

Oct. 1976 221 p refs

(Contract ESTEC-2447/75)

(FO-1332; ESA-CR(P)-858) Avail: NTIS HC A10/MF A01

A study has been carried out of an active thermal control system for spacecraft which consists of a fluid loop that connects a heat source with a heat sink. Heat transport from source to sink is achieved by forced convection with a coolant circulating in the loop. Three fluid loop systems have been defined based on different heat sinks: a standard counterflow liquid/liquid heat exchanger, a liquid/air crossflow multi-pass heat exchanger, and a space radiator. It is shown that, for a given heat transport rate, there must exist a minimum positive difference between source and sink temperatures. In the case of smaller or negative temperature differences a heat pump must be incorporated in the loop. It is estimated that fluid loop systems without heat pumps designed for heat transport rates of up to a few kW will have a mass of approximately 10 kg. The power requirement of a heat pump depends strongly on the difference between source and sink temperatures and is approximately proportional to the heat transport rate. Author (ESA)

N77-17409# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.

REMARKS ON THE ANALYSIS OF HOT-WIRE SIGNALS OF HIGHLY TURBULENT FLOWS

Manfred Bartenwerfer 6 Aug. 1976 24 p refs In GERMAN; ENGLISH summary

(DLR-FB-76-41) Avail: NTIS HC A02/MF A01; DFVLR, Cologne, DM 11.30

The calculation of the local turbulence intensities and the Reynolds stresses from hot-wire signals in turbulent flow, point to the shortcomings of known formulas from linear approximations, and give new formulas which stem from a non-linear approximation. These formulas are valid for a linearized constant-temperature X-wire and include corrections for the tangential cooling of the wires, for high turbulence intensity and for anisotropy of the turbulence. The given correction factors can be deduced completely from measurements using standard turbulence intensity meters. Author (ESA)

N77-17410# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

COMPUTER PROGRAM FOR CALCULATIONS OF PARTICLE TRAJECTORIES THROUGH A ROTATING CASCADE

M. Fathy Hussein and W. Tabakoff May 1976 99 p refs

(Contract DAHC04-69-C-0016)

(AD-A027879; ARO-T-4-76-E; Rept-76-47) Avail: NTIS HC A05/MF A01 CSCL 20/8

This report gives a listing of the computer program used to calculate the three dimensional absolute paths of particles through a rotating cascade, their trajectories relative to the rotor and their velocity histories. The program considers the impact and rebound of particles with the blade walls or casing. The program is written for axial flow machines and may be modified to handle other types. The program procedures, description of the program input and output as well as program subroutines and their functions are discussed. Author (GRA)

N77-17411# Office of Naval Research, London (England).

INTERNATIONAL HEAT PIPE CONFERENCE (2ND)

Robert F. Lopina 1976 15 p Conf. held at Bologna, 31 Mar. - 2 Apr. 1976

(AD-A029174; ONRL-C-19-76) Avail: NTIS HC A02/MF A01 CSCL 20/13

This report summarizes the presentation at a three-day international meeting on heat pipe research and developments. The meeting dealt with gravity-assist heat pipes, low temperature heat pipes, variable conductance heat pipes, rotating heat pipes, heat-pipe materials, evaporative heat transfer mechanisms, zero-gravity testing and terrestrial and spacecraft applications of heat pipes. Author (GRA)

N77-17412# California Univ., Riverside. Dept. of Mathematics.

MATHEMATICS OF FLUID FLOW AND ELASTICITY Final Report, 1 Dec. 1972 - 30 Jun. 1976

Victor L. Shapiro 1976 22 p

(Grant AF-AFOSR-2456-73; AF Proj. 9749)

(AD-A029336; AFOSR-76-1077TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The main part of this paper consists of a description of the following 7 research papers: Positive Newtonian capacity and stationary viscous incompressible flow, Generalized and classical solutions of the nonlinear stationary Navier-Stokes equations, Isolated singularities in fluid flow and elasticity, Isolated singularities in steady-state fluid flow, A counter-example in theory of planar viscous incompressible flow, The discrete equations of fluid flow and elasticity, Subharmonic functions and Hausdorff measure. In these papers, new results were obtained for the nonlinear stationary Navier-Stokes equations---the basic equations in the mathematical theory of viscous incompressible flow. Also new results were obtained in the area of linear elasticity. Author (GRA)

N77-17413# Wisconsin Univ., Madison. Mathematics Research Center.

DUAL EXTREMUM PRINCIPLES FOR DISSIPATIVE SYSTEMS Technical Summary Report

W. D. Collins Apr. 1976 86 p refs

(Contract DAAG29-75-C-0024)

(AD-A027962; MRC-TSR-1624) Avail: NTIS HC A05/MF A01 CSCL 12/1

Dual extremum principles characterizing the solution of initial-value problems for the heat equation and similar equations arising in dissipative systems are obtained by imbedding the initial-value problem in a two-point boundary-value problem for a system in which the original equation is coupled with its adjoint. Bounds on quantities of interest in the original initial-value problem and error bounds on the solution of this problem are obtained. Such principles are first obtained for a dissipative system on a Hilbert space and application then made to initial-value problems for the heat equation and the equations of slow viscous flow. GRA

N77-17414# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A USERS MANUAL FOR COMPUTER CODE NOZZLE

John F. Polk Aug. 1976 46 p refs

(DA Proj. 1W1-61102-AH-43)

(AD-A028971; BRL-MR-2659) Avail: NTIS HC A03/MF A01 CSCL 20/4

A perturbation formula to describe the flow in the transonic region of an axisymmetric nozzle is combined with a computer code which calculates the flow in the supersonic region by the method of characteristics. The perturbation parameter used in the transonic analysis is the normalized radius of curvature of the nozzle throat. Instructions for running the combined code, called NOZZLE, and a tabulation of the output from a test case are included. Author (GRA)

N77-17415# Science Applications, Inc., La Jolla, Calif.

SKIMMER: A NUMERICAL MODEL FOR NONLINEAR WAVES Final Report, Oct. 1973 - Jan. 1976

G. T. Phillips and R. K.-C. Chan 27 Aug. 1976 43 p refs

(Contract N00014-74-C-0118; SR0230101)

(AD-A029231; SAI-76-605-LJ) Avail: NTIS HC A03/MF A01 CSCL 20/4

The calculation on nonlinear free surface waves produced by a moving disturbance on a free surface was studied using a time-dependent numerical model. Two frames of reference were tried in making the calculations, one fixed to the surface disturbance, and the other fixed to a laboratory reference frame. Verification studies were performed which indicate the model is capable of accurately reproducing both linear and nonlinear wave profiles, in either frame of reference. However, calculations, in which the disturbance was assumed to be fixed with the fluid

streaming past it, were found to be more efficient in terms of computer storage and time. Author (GRA)

N77-17416# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF THE EFFICIENCY AND ENTRAINMENT RATES OF A FLUIDICALLY OSCILLATED JET M.S. Thesis
Richard James Veltman Jun. 1976 98 p refs
(AD-A028437) Avail: NTIS HC A05/MF A01 CSCL 20/4

A study was made of the nozzle efficiency and entrainment rates of jets which were made to oscillate by fluidic means. The entrainment rates were determined using conventional pitot-static tubes which indicated significant increases for the oscillatory jet versus the steady jet. Also, work was started to verify these results using the Ricou-Spalding entrainment chamber. GRA

N77-17417# Naval Postgraduate School, Monterey, Calif.
LASER DOPPLER ANEMOMETER MEASUREMENT AND ANALYTICAL COMPARISON OF FLOW AROUND A CYLINDER AT LOW REYNOLDS NUMBER M.S. Thesis
Terry Scott Wanner Mar. 1976 63 p refs
(AD-A028866) Avail: NTIS HC A04/MF A01 CSCL 20/4

In this study, the flow characteristics of air around a circular cylinder were determined by two means: by analytical solution of the Navier-Stokes equations, and actual measurement of the flow itself. A DISA LD 5586 laser Doppler anemometer system was employed to measure normal (v) and parallel (u) velocity components of a laminar flow regime about a three-sixteenths inch diameter cylinder mounted in a 32 x 45 inch wind tunnel (Reynolds number approximately 40). GRA

N77-17418# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
APPLICATION OF AN INTERACTING BOUNDARY LAYER MODEL TO THE SUPERSONIC TURBULENT SEPARATION PROBLEM Final Report
M. J. Werle and S. D. Bertke Aug. 1976 58 p refs
(Contract N60921-74-C-0203)
(AD-A029328; AFL-76-4-21) Avail: NTIS HC A04/MF A01 CSCL 20/4

Numerical solutions to the supersonic interacting turbulent boundary layer equations are obtained for ramp induced separation problems. The method used is the alternating direction implicit scheme wherein a time-like relaxation process is followed to a sought after steady state. The turbulent structure of the flow is modeled with an eddy viscosity approach using both the equilibrium and relaxation models. Detailed comparisons of the present solution with experimental data and available Navier Stokes solutions show that this approach fails to predict the correct extent of upstream influence. The deficiency is traced to the absence of an imbedded shock wave in the interacting boundary layer model of the viscous region. Author (GRA)

N77-17419# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
NUMERICAL SOLUTION FOR THREE DIMENSIONAL ROTATIONAL FLOW IN CASCADES
W. Hosny and W. Tabakoff Jun. 1976 133 p refs
(Contract DAAG29-69-C-0016)
(AD-A028764; Rept-76-48; ARO-T-4-77-E) Avail: NTIS HC A07/MF A01 CSCL 20/4

A theoretical analysis is established to deal with the inviscid three dimensional rotational flow which results from the secondary vorticity in turning channels. The equations of motion are written and manipulated in a special form to include the secondary vorticity as a variable among the other flow variables. The equations in their forms are not attractable to analytic solutions and therefore numerical solutions are adopted. The solution to the problem in general yields to the full picture of the three dimensional flow together with the different characteristics of the secondary vorticity distribution in the flow field. Since there was no limitation on the flow deflection angle, the channel radius of curvature or the flow inlet shear, the analysis is then recommended to be used to obtain the rotational flow in the channels of highly loaded turbomachinery cascades. Author (GRA)

N77-17420# Pennsylvania State Univ., University Park. Applied Research Lab.
INFLUENCE OF GAS CONTENT AND POLYETHYLENE
C. B. Baker, J. W. Holl, and R. E. A. Arndt 13 Nov. 1975 17 p refs Presented at the Cavitation and Polyphase Flow Forum, Joint Fluids Eng. and Gas Turbine Conf., New Orleans, 21-25 Mar. 1976 Submitted for publication
(Contract N00017-73-C-1418)
(AD-A028577; TM-75-274) Avail: NTIS HC A02/MF A01 CSCL 20/4

Desinent cavitation data were obtained for confined water jets generated by a 5.08 cm (2 in.) diameter sharp-edged orifice and a contoured nozzle of the same diameter. Data were acquired over a range of total air content from 2.0 to 12.0 parts per million (mole basis) in water and a water polyox (WSR-301) solution of 100 parts per million (weight basis). The jet velocity was constant at 9.1 m/s (30 f/s). In general the polyox caused a reduction in the desinent cavitation index and the reduction increased with air content. However, below an air content of 4.0 ppm the desinent cavitation index is apparently independent of air content. GRA

N77-17421# Pennsylvania State Univ., University Park. Applied Research Lab.
DRAG REDUCTION IN TWO PHASE AND POLYMER FLOWS
J. L. Lumley 15 Jun. 1976 48 p refs
(Contract N00017-73-C-1418)
(AD-A028612; TM-76-173) Avail: NTIS HC A03/MF A01 CSCL 20/4

The basic dynamics of turbulent boundary layers of several media is described qualitatively: suspensions of several types and polymer solutions. Despite the considerable differences in these media, it is argued that a number of the flows are affected only in the buffer layer, and drag reduction can result if behavior in the sublayer and buffer layer differ. In polymer solutions, it is argued that molecular expansion is responsible for the difference, and experimental evidence of this expansion is presented, and compared with calculations. It is shown how the so-called diameter effect sheds light on the lift-time of the dissipative eddies through their role in producing the molecular expansion. Author (GRA)

N77-17422# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
NATIONAL MEASUREMENT SYSTEM FOR FLUID FLOW Final Report
William C. Haight, P. S. Klebanoff, Fillmer W. Ruegg, and Gershon Kulin Aug. 1976 67 p refs
(PB-258250/0; NBSIR-75-930) Avail: NTIS HC A04/MF A01 CSCL 20D

The concept of the National Measurement System for Fluid Flow are presented. The basic structural elements for describing fluid response are discussed along with flow measurement standards, and instruments. F.O.S.

N77-17423# TRW Systems, Redondo Beach, Calif.
FLOW AND GAS SAMPLING MANUAL Final Report
E. F. Brooks and R. L. Williams Jul. 1976 102 p refs
(Contract EPA-68-02-1412)
(PB-258080/1; EPA-600/2-76-203) Avail: NTIS HC A06/MF A01 CSCL 14B

Current technology for the measurement of total volumetric flow in process stream ducts and for the extraction of representative gas samples was delineated. Techniques and hardware used to obtain optimum measurement accuracies while minimizing measurement system complexity and labor requirements are noted. Composition and flow measurements in large process stream ducts were routinely made with accuracies on the order of 5% to 10% on a continuous basis using available hardware and techniques. GRA

N77-17424# Naval Postgraduate School, Monterey, Calif.
FINITE DIFFERENCE TREATMENT OF TRANSIENT TEMPERATURE DISTRIBUTION IN AN INSULATED PIPE
John E. Brock Oct. 1976 39 p refs
(AD-A030103; NPS-69BC76101) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report discusses a Crank-Nicolson type of finite difference

formulation for the problem of transient temperature distribution in a uniform cylindrical pipe with external insulation and containing a fluid for which temperature, pressure, and flow rate are given as functions of time. All material properties are assumed to depend on temperature. Discussion is also given of a digital computer program which implements this formulation. This implementation incorporates properties of superheated steam, the internal fluid, and of 2-1/4 Cr 1 Mo (P22), the pipe material. Stress calculations are also treated. Author (GRA)

N77-17425# Mitsubishi Heavy-Industries Ltd., Tokyo (Japan).
DIGITAL DYNAMIC SIMULATION PROGRAM ESPECIALLY DESIGNED FOR HEAT EXCHANGE PROCESSES, HEDDY
Michitsune Shima, Toshitaka Fujiwara, Hideo Takata, and Ryoichi Murata Nov. 1976 9 p refs
(MTB-114) Avail: NTIS HC A02/MF A01

A digital simulation program named HEDDY (heat exchanger digital dynamic simulator) is introduced. The HEDDY has been developed as a powerful means for the analysis of the dynamic behavior of large systems with heat exchangers as the main components, for example, steam generating plants, nuclear power plants, water chiller plants, etc., and also for the design of automatic control systems. It is aimed at reducing trouble to be taken for programming (coding and debugging) and the time required for calculation, and has the following features: the users can compose any process simulator with its control system easily, and it is capable of speeding up numerical calculation by treating a set of fundamental equations by transforming them into serial combination with a time lag of first order by the techniques called quasilinearization and differential operator. Author

N77-17308# Osaka Univ. (Japan). Dept. of Mechanical Engineering.
ON THE AXI-SYMMETRIC LAMINAR FLOW OF LIQUID JET
Yutaka Miyake and Chihiro Yamaji *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 527-538 refs (For primary document see N77-17291 08-31)
(Rept-1326) Avail: NTIS HC A10/MF A01

N77-17309# Osaka Univ. (Japan). Dept. of Mechanical Engineering.
HEAT TRANSFER TO WATER FLOW IN A TUBE UNDER VERY HIGH PRESSURE
Seikan Ishigai, Masuo Kaji, Shinichi Takai (Kobe Steel Co., Ltd.), and Takashi Izumi (Mitsubishi Atomic Power industries, Inc.) *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 539-546 refs (For primary document see N77-17291 08-31)
(Rept-1327) Avail: NTIS HC A10/MF A01

N77-17310# Osaka Univ. (Japan). Dept. of Mechanical Engineering for Industrial Machinery.
SIMULTANEOUS MEASUREMENT OF LOCAL LIQUID VELOCITY AND VOID FRACTION IN BUBBLY FLOWS USING A GAS LASER. PART 1: PRINCIPLE AND MEASURING PROCEDURE
Kenkichi Ohba, Ichiro Kishimoto, and Mitsunobu Ogasawara *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 547-556 refs (For primary document see N77-17291 08-31)
(Rept-1328) Avail: NTIS HC A10/MF A01

N77-17314# Osaka Univ. (Japan). Dept. of Naval Architecture.
AN EXACT INTEGRAL METHOD FOR SOLVING THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER EQUATION AROUND SHIP HULLS
Joji Himeno (Univ. of Osaka Prefecture, Sakai) and Ichiro Tanaka *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 583-594 refs Submitted for publication (For primary document see N77-17291 08-31)
(Rept-1332) Avail: NTIS HC A10/MF A01

N77-17680*# Martin Marietta Corp., Denver, Colo.
BEHAVIOR OF FLUIDS IN A WEIGHTLESS ENVIRONMENT
Dale A. Fester, Ralph N. Eberhardt, and James R. Tegart *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 37-52 refs (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-17426* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF AND MEANS FOR TESTING A TAPE RECORD/PLAYBACK SYSTEM Patent
Gabriel R. Wallace, William E. Salter (Sperry Rand Corp., Huntsville, Ala.), Glenn D. Weathers (Sperry Rand Corp., Huntsville, Ala.), and Sidney S. Gussow, inventors (to NASA) (Sperry Rand Corp., Huntsville, Ala.) Issued 11 Jan. 1977 6 p Filed 25 Mar. 1975 Supersedes N75-31418 (13 - 22, p 2787) Division of US Patent Appl. SN-419831, filed 28 Nov. 1973, US Patent-3,875,500
(NASA-Case-MFS-22671-2; US-Patent-4,003,084; US-Patent-Appl-SN-561956; US-Patent-Class-360-31; US-Patent-Class-360-25; US-Patent-Appl-SN-419831; US-Patent-3,875,500) Avail: US Patent Office CSCL 14B

A tape record/playback system was tested by first deriving an analog test signal and a band-limited digital reference signal from a pseudo-noise sequence generator driven by a clock signal. It recorded the signals on respective tracks of the system during operation in a record mode. During the playback mode of operation of the system, a delayed analog reference signal without time base variations was reconstructed from the played back reference signal. It was compared with the played back test signal in order to obtain an error signal that was a measure of the performance of the system.
Official Gazette of the U.S. Patent Office

N77-17427*# Athens Coll., Ala.
EXPLORATORY LOADING TECHNIQUES Final Report
Ashley M. Martin, III 29 Nov. 1976 24 p ref
(Contract NAS8-30880)
(NASA-CR-150182) Avail: NTIS HC A02/MF A01 CSCL 14E

Interferometric holographic nondestructive testing of aluminum, copper, and steel flat plates is reported. Structural weaknesses under positive pressure, negative pressure, heating, and cooling are discussed. Author

N77-17428*# Eastman Kodak Co., Rochester, N.Y. Apparatus Div.
PHOTOGRAPHIC CONSULTING SERVICES TO THE EARTH RESOURCES PROGRAM Final Report
17 Jul. 1976 278 p
(Contract NASw-2317)
(NASA-CR-149587) Avail: NTIS HC A13/MF A01 CSCL 14E

The recommendations, procedures, and techniques are summarized which provided by the Kodak Apparatus Division to the Ames Research Center to support the Earth Resources Aircraft Program at that facility. Recommendations, procedures, and calibration data are included for sensitometry, densitometry, laboratory cleanliness, and determination of camera exposure. Additional comments are made regarding process control procedures and general laboratory operations. Author

N77-17429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LASER DOPPLER, VELOCIMETER SYSTEM FOR TURBINE STATOR CASCADE STUDIES AND ANALYSIS OF STATISTICAL BIASING ERRORS

Richard G. Seasholtz Washington Feb. 1977 48 p refs
(NASA-TN-D-8297; E-8799) Avail: NTIS HC A03/MF A01 CSCL 14B

A laser Doppler velocimeter (LDV) built for use in the Lewis Research Center's turbine stator cascade facilities is described. The signal processing and self contained data processing are based on a computing counter. A procedure is given for mode matching the laser to the probe volume. An analysis is presented of biasing errors that were observed in turbulent flow when the mean flow was not normal to the fringes. Author

N77-17430*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAGNETOMETER Patent Application
William J. Debnam, Carl L. Fales, Jr., Roger A. Breckenridge, and Arthur V. Pohm, inventors (to NASA) (Iowa State Univ. of Sci. and Technol.) Filed 19 Mar. 1976 13 p
(NASA-Case-LAR-11617-2; US-Patent-Appl-SN-668771) Avail: NTIS HC A02/MF A01 CSCL 14B

A magnetometer is described which has a flat miniature transducer capable of being scanned automatically. The transducer has an active region of approximately 0.64 mm by 0.76 mm with good spatial resolution of magnetic fields as low as 0.02 oe. Magnetic fields as close as 0.08 mm from any relatively flat surface can be measured. Its effectiveness is demonstrated in determining the presence of magnetic remanence in the magnetic strap keepers on memory planes of experimental and production line plated-wire memories, and in measuring the transverse magnetic field components at the surface of geological rock specimens. NASA

N77-17431*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
PROBLEMS ASSOCIATED WITH ATTACHING STRAIN GAGES TO TITANIUM ALLOY Ti-6Al-4V
Jerald M. Jenkins and M. M. Lemcoe (Battelle Columbus Labs., Ohio) Feb. 1977 19 p refs
(NASA-TM-X-56044; H-970) Avail: NTIS HC A02/MF A01 CSCL 14B

Weldable strain gages have shown excellent high temperature characteristics for supersonic cruise aircraft application. The spotwelding attachment method, however, has resulted in serious reductions in the fatigue life of titanium alloy (Ti-6Al-4V) fatigue specimens. The reduction is so severe that the use of weldable strain gages on operational aircraft must be prohibited. The cause of the fatigue problem is thought to be a combination of the microstructure changes in the material caused by spotwelding and the presence of the flange of the stain gage. Brazing, plating, and plasma spraying were investigated as substitutes for spotwelding. The attachment of a flangeless gage by plasma spraying provided the most improvement in the fatigue life of the titanium. Author

N77-17432# Battelle Pacific Northwest Labs., Richland, Wash.
APPLICATION OF FERROFLUID DENSITY SEPARATION TO PARTICLES IN THE MICROMETER-SIZE RANGE
R. S. Strebin, Jr., J. W. Johnson, and D. M. Robertson Feb. 1976 24 p refs
(Contract AT(45-1)-1830)
(BNWL-B-461) Avail: NTIS HC A02/MF A01

A device described as a Ferrofluid Density Separator develops an apparent fluid density from nominally 2 to 20 g/cubic cm dependent on the magnitude of an imposed magnetic field gradient. The ferrofluid retains other normal properties of a liquid. One of these devices and a concentration series of ferrofluids were obtained in order to determine the practicality of separating groups of micrometer-size particles into density fractions. The results of a study of separations of micrometer-size particles with the ferrofluid density separator are presented. ERA

N77-17433# California Univ., Livermore. Lawrence Livermore Lab.
TIME-RESOLVED FAST-NEUTRON PINHOLE CAMERA FOR STUDYING THERMONUCLEAR PLASMAS
R. W. Bauer 2 Feb. 1976 41 p refs Presented at Conf. on Diagnostics of High Temperature Plasmas, Oak Ridge, Tenn., 7-9 Jan. 1976
(Contract W-7405-eng-48)
(UCRL-77527; Conf-760128-1) Avail: NTIS HC A03/MF A01

The pinhole consists of a specially designed 1.15 m long copper collimator with an effective aperture of 1 mm diameter. Several different types of spatial resolution detectors have been used at the image plane: (1) a multi-element, scintillation-photomultiplier system used for time-resolved measurements consisting of sixty-one individual detectors, (2) a scintillation-fiber-chamber coupled to a gated image-intensifier tube used for direct photographing of the neutron image, and (3) a propane bubble chamber used for time-integrated recording. Pulsed neutron sources with typical dimensions of 1 cm emitting of the order of 10 to the 12th power neutrons over a time period of 10-100 nsec have been investigated. A spatial resolution of 1 mm and a time resolution of approximately 10 nsec was achieved in the investigations of dense plasma compression phenomena. ERA

N77-17434# Sandia Labs., Albuquerque, N.Mex.
MODIFICATIONS TO A COMMERCIAL INFRARED RADIOMETER TO EXTEND ITS TEMPERATURE RANGE AND SPECTRAL RESOLUTION
George Staller, E. A. Igel, and M. M. Robertson Apr. 1976 12 p refs
(Contract AT(29-1)-789)
(SAND-76-0025) Avail: NTIS HC A02/MF A01

A commercial infrared radiometric microscope has been modified to extend its temperature measuring range and to increase its wavelength selectivity. Those modifications, which involve utilization of neutral density and bandpass filters, are discussed. ERA

N77-17435# California Univ., Livermore. Lawrence Livermore Lab.
DISCRIMINATOR/TIME INTERVAL METER SYSTEM EVALUATION REPORT
Kenneth J. Condreva 12 Apr. 1976 110 p refs
(Contract W-7405-eng-48)
(UCID-17069) Avail: NTIS HC A06/MF A01

The characteristics, operation and calibration of each of the hardware components are discussed in some detail. A discussion of the system calibration, operation, and data ingestion and reduction is also given. System test results to date are given and discussed. Finally, recommendations and conclusions concerning the capabilities of the discriminator/system based on test and calibration results to date are given. ERA

N77-17436# Wisconsin Univ., Madison. Medical Physics Labs.
THERMOCURRENT DOSIMETRY WITH HIGH PURITY ALUMINUM OXIDE
Gary D. Fullerton, John R. Cameron, and P. R. Moran 1976 143 p refs Sponsored by ERDA
(COO-1105-217) Avail: NTIS HC A07/MF A01

The application of thermocurrent (TC) to ionizing radiation dosimetry was studied. TC in alumina has properties that are suited to personnel dosimetry and environmental monitoring. TC dosimeters were made from thin disks of alumina. Aluminum electrodes were evaporated on each side: on one face a high voltage electrode and on the opposite face a measuring electrode encircled by a guard ring. Exposure to ionizing radiation resulted in stored electrons and holes in metastable trapping sites. The signal was read-out by heating the dosimeter with a voltage source and picnometer connected in series between the opposite electrodes. The thermally remobilized charge caused a transient TC. The thermogram, TC versus time or temperature, is similar to a TL glow curve. Either the peak current or the integrated current is a measure of absorbed dose. ERA

N77-17437# Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
SOME NEW CHARACTERISTICS OF A POLYCARBONATE FAST NEUTRON PERSONNEL DOSIMETER
M. Sohrabi and K. Z. Morgan 1976 39 p refs Presented at the Am. Industrial Hygiene Conf., Atlanta, 16-21 May 1976
(Contract AT(40-1)-4814)
(ORO-4814-8; Conf-760525-1) Avail: NTIS HC A03/MF A01

Among various existing techniques, registration of fast-

neutron-induced recoil and particle tracks directly in sensitive polymers such as polycarbonate foils provides a simple, sensitive and inexpensive means of fast neutron personnel dosimetry when recoil tracks are electrochemically etched. Some characteristics of this technique, including dose range, directional response, energy dependence, fading characteristics, etc., are reported. ERA

N77-17438# Sandia Labs., Albuquerque, N.Mex. Generator Development Div.
IMPROVED SYSTEM FOR THE MEASUREMENT OF HIGH-VOLTAGE PULSES
William A. Stephenson May 1976 28 p
(Contract AT(29-1)-789)
(SAND-75-0470) Avail: NTIS HC A03/MF A01

A small 71.8 mm x 127 mm capacitive voltage divider is described that is used for measuring waveforms in the 200 kilovolt range with durations of tens of microseconds. The device, immersed in a dielectric fluid, works over the temperature range of 219 to 347 K (-65 to +165 F). The divider works into an electronic impedance matching line driver which has selectable division ratios of 10,000, 20,000, 30,000, and works into a 50-ohm load. Total deviation in division ratio for the system is in the order of +1.5 percent to -1.05 percent. ERA

N77-17439# Institut Franco-Allemand de Recherches, St. Louis (France).
APPLICATION OF HOLOGRAPHIC INTERFEROMETRY BY DOUBLE EXPOSURE TO THE INVESTIGATION OF THE BEGINNING DEFORMATION OF A HARD MATERIAL UNDERGOING THE IMPACT OF PROJECTILES
Ph.D. Thesis - Besancon Univ., France
Felix Albe 26 May 1976 164 p refs In FRENCH; ENGLISH summary
(ISL-R-114/76) Avail: NTIS HC A08/MF A01

An arrangement based on the use of holographic interferometry by double exposure was designed and built. This arrangement was used together with a ruby laser serving as a coherent light source in order to visualize and measure the dynamic deformations of a ceramic plate subjected to the impact of projectiles. Thus the deformations occurring on the rear side of the plate can be recorded at several instants prior to the beginning of the fracture. Two projectile velocities are considered, that is, a low velocity range (100 to 300 m/s) and high velocities (800 m/s). For high-velocity investigations, a system including two ruby lasers was developed which generates two pulses within a very short and adjustable period of time (0.1 to several microsec). The pulse duration of the ruby laser was then reduced from 20 to 5 ns. An investigation of certain parameters governing the phenomenon makes it possible to explain the deformation and to obtain information on the influence of ceramics used as a first layer in certain composite armors. Author (ESA)

N77-17440# Office of Naval Research, London (England).
HOLOGRAPHIC GRATINGS AND ZONE PLATES
W. R. Hunter 16 Jul. 1976 28 p refs
(AD-A029031; ONRL-R-5-76) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report is a tutorial treatment of diffraction gratings and zone plates, with emphasis on modern holographic methods of generating these optical components. The report is based upon recent visits to several research establishments in the U.K. and on the Continent. Author (GRA)

N77-17441# California Univ., Livermore. Lawrence Livermore Lab.
PHOTODENSITOMETER MEASUREMENTS OF IMAGES ON RADIOGRAPHS
G. M. Taylor 12 Mar. 1976 25 p refs
(Contract W-7405-eng-48)
(UCRL-52037) Avail: NTIS HC A02/MF A01

An X-ray photodensitometer provided accurate and precise measurements of linear dimensions on radiograph images. These measurements helped to infer the hidden dimensions of objects radiographed. Systematic errors caused the errors in absolute value to be considerably higher in some cases. Many deterrents to successful measurement arose, including film grain noise, excessive density range and edge penetration, blurring, interfering structures, and scattered radiation. Film grain noise, in particular, limited the resolution of small details in a radiograph. Because of so many deterrents, the applicability of the measurement method used appeared quite limited. ERA

N77-17442# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN OPTICAL DISC RECORDER Quarterly Technical Report, 1 Apr. - 30 Jun. 1976
George Kenney, D. Lou, J. Wagner, A. Chan, and T. Demetrakopoulos Aug. 1976 50 p
(Contract N00014-76-C-0441; ARPA Order 3080)
(AD-A029230; PL-21-YR-76-0815) Avail: NTIS HC A03/MF A01 CSCL 14/3

First testing of the recorder is underway. Some tracks were recorded on plastic discs coated with tellurium films. Laser machining of holes in static films of various materials reveals tellurium as an attractive DRAW candidate. The principle advantages of tellurium film (compared to bismuth) are improved sensitivity and stability at high temperature. Detailed analysis of the air-sandwich protective mechanism continues. The first results of the digital coding task force study are being analyzed. A study of accelerated life testing of bismuth and tellurium film was initiated. Author (GRA)

N77-17443# Air Force Academy, Colo.
ADVANCED SENSOR TECHNOLOGY Interim Report
S. J. Monaco and Shigeo Okubo Feb. 1976 64 p
(AF Proj. 2304)
(AD-A028940; SRL-TR-76-0004) Avail: NTIS HC A04/MF A01 CSCL 14/2

The report discusses work on the design, development, and applications of several new sensors which include a mercury level tiltmeter, a soil stress indicator, a flexural rigidity sensor, a 3-axis angular motion sensor, and an angular differentiating accelerometer. These sensors have the potential of providing an important technology in the areas of guidance and control, security systems, construction and mining safety, non-destructive testing, blast and shock detection, and precision monitoring of environmental conditions. GRA

N77-17444# National Inst. for Occupational Safety and Health, Morgantown, W.Va. Testing and Certification Lab.
INDUSTRIAL SOUND LEVEL METER SCALE OF THE INDICATING INSTRUMENT TEST
Robert J. Koshut 1976 18 p refs
(PB-257905/0; NIOSH/TC/P-007) Avail: NTIS HC A02/MF A01 CSCL 14B

The test procedure checks the accuracy of the scale used on the industrial sound level meter when attenuated signals are applied to the industrial sound level meter. A list of equipment needed to perform the test and the configuration in which the equipment are to be used are included. GRA

N77-17445# Physics International Co., San Leandro, Calif.
ELECTRICAL INTEGRATION CIRCUITS FOR USE WITH PZ ACCELEROMETERS FOR FIELD MEASUREMENTS OF VELOCITY Final Report, Mar. 1972 - Jun. 1975
C. T. Vincent Jul. 1976 52 p refs
(Contract DNA001-72-C-0128; DNA Proj. NWET-J24CAXYX984)
(AD-A029035; DNA-3973F; DNA-POR-407) Avail: NTIS HC A04/MF A01 CSCL 09/5

A study is made of several types of electrical integration circuits for use with PZ accelerometers in making velocity measurements. Their suitability is evaluated on the basis of use on non-nuclear events. Baseline drift, frequency range, accuracy, and ease of use are parameters used for evaluation. Author (GRA)

N77-17446# Naval Postgraduate School, Monterey, Calif.
STUDY AND DESIGN OF FLIGHT DATA RECORDING SYSTEMS FOR MILITARY AIRCRAFT M.S. Thesis
Lloyd Norman Baetz Jun. 1976 129 p refs
(AD-A028862) Avail: NTIS HC A07/MF A01 CSCL 01/2

Investigation of aircraft wreckage does not provide crash investigators with adequate information. Crash-protected flight recorder data is invaluable when determining accident cause factors. Inertial navigation systems provide an excellent source

of highly accurate flight parameters. Nonvolatile solid state memory is available which can replace failure prone magnetic tape recording in flight recorder systems. Microprocessors are available with the capability of compressing flight data for solid state memory storage. Data compression trials indicate that a flight data recording system using microcomputer preprocessing and nonvolatile solid state memory is feasible. GRA

N77-17447# Naval Intelligence Support Center, Washington, D.C.
AUTOMATED MARINE PROTON MAGNETOMETER APM-1
Yu. V. Terekhin, O. A. Prostun, V. V. Polyakov, and V. A. Krovotyntsev 30 Jun. 1976 9 p refs Transl. into ENGLISH from Akad. Nauk URSR Morsk. Hidrofizychnyi Inst., Tr. (Kiev), v. 1, n. 57, 1972 p 106-114
(AD-A028719; NISC-Trans-3821) Avail: NTIS HC A02/MF A01 CSCL 08/10

The article gives a description of an automated marine proton magnetometer APM-1. Results of a study of different types of sensors and the selection of the optimum sensor from several designs are given. The principal units of the instruments are described, together with results of determination of the deviation, convergence of readings, and metrological tests. GRA

N77-17270*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TESTING THINNED, BACKSIDE ILLUMINATED CCD AREA IMAGE SENSORS
George Root *In its* Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 63-71 refs (For primary document see N77-17263 08-31)
(Contract NAS7-100)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-17271*# Martin Marietta Aerospace, Orlando, Fla.
HIGH DATA RATE PERFORMANCE OF A BCCD FOR RAPID SCAN IMAGING
David E. Schmieder and Stanley P. Buchanan *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 72-82 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-17272*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
LOW-NOISE VIDEO AMPLIFIERS FOR IMAGING CCD'S
Frank Scinicariello *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 83-88 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-17275*# Electronic Vision Corp., San Diego, Calif.
RECENT PROGRESS IN PHOTOELECTRON IMAGE DETECTION WITH CCDS
John P. Choisser *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 101-105 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-17281*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
RECON 6: A REAL-TIME, WIDE-ANGLE, SOLID-STATE RECONNAISSANCE CAMERA SYSTEM FOR HIGH-SPEED, LOW-ALTITUDE AIRCRAFT
Richard L. Labinger *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 129-134 (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14E

N77-17283*# IBM Watson Research Center, Yorktown Heights, N.Y.
CHARGE COUPLED DEVICE INTEGRATION-TIME CODING FOR DETECTION OF IMAGES MOVING WITH UNKNOWN VELOCITIES
J. M. White and G. W. Lynch *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 139-144 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-17284*# California Univ., Livermore. Lawrence Livermore Lab.
A HIGH SPEED IMAGING SYSTEM FOR NUCLEAR DIAGNOSTICS
Harold H. Eyer *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 145-151 (For primary document see N77-17263 08-31)
(Contract W-7405-eng-48)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-17286*# Texas Instruments, Inc., Dallas.
DEVELOPMENT OF LARGE AREA CCD IMAGERS
G. W. Taylor, G. A. Antcliffe, and G. L. Streckmann *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 3 p refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-17288*# Maryland Univ., College Park.
A PHOTON COUNTING ARRAY PHOTOMETER USING AN INTENSIFIED CHARGE COUPLED DEVICE
Douglas G. Currie *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 21 p refs (For primary document see N77-17263 08-31)
(Grant NGR-21-002-444; Contract N00014-75-C-0343; Grant NSF MPS-74-05890-001)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-17289*# Texas Instruments, Inc., Dallas.
CCD CORRELATION TECHNIQUES
C. R. Hewes, P. W. Bosshart, W. L. Eversole, M. DeWit, and D. D. Buss *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 6 p refs Sponsored by NASA Langley Res. Center (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 14B

N77-17290*# Honeywell Radiation Center, Lexington, Mass.
A CCD SCANNED (Hg, Cd)Te ARRAY FOR EARTH VIEWING APPLICATIONS
S. Iwasa and W. J. White *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 6 p refs (For primary document see N77-17263 08-31)
(Contract NAS5-22339)
Avail: NTIS HC A11/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-17448*# Illinois Univ., Urbana. Radio Research Lab.
STATISTICS OF THE RESIDUAL REFRACTION ERRORS IN LASER RANGING DATA Final Report
C. S. Gardner Jan. 1977 43 p refs
(Grant NsG-5049)
(NASA-CR-149526; RRL-Publ-481; UILU-ENG-77-2544) Avail: NTIS HC A03/MF A01 CSCL 20E

A theoretical model for the range error covariance was derived by assuming that the residual refraction errors are due entirely to errors in the meteorological data which are used to calculate the atmospheric correction. The properties of the covariance function are illustrated by evaluating the theoretical model for the special case of a dense network of weather stations uniformly distributed within a circle. Author

N77-17449# California Univ., Livermore. Lawrence Livermore Lab.
CURRENT STATUS OF LLL FOUR-D ATMOSPHERIC PROPAGATION CODE EFFORT
J. A. Fleck, Jr. and J. R. Morris 16 Mar. 1976 21 p refs
(Contract W-7405-eng-48)
(UCID-16827-2) Avail: NTIS HC A02/MF A01

The scenario capability of the Four-D code was generalized from the previous coplanar version, which assumed a moving laser platform, a target on a collision course with the platform, and an arbitrarily oriented coplanar wind. The laser was displaced to any height above the platform, and the scenario plane was arbitrarily oriented with respect to the horizon. The scenario routine

returned to the hydrodynamics routine of the code a transverse wind velocity vector of varying magnitude and orientation. The hydrodynamics routine of the Four-D code was capable of treating both CW and multipulse steady state sources with winds of arbitrary magnitude and direction relative to the x-axis. ERA

N77-17450# California Univ., Livermore. Lawrence Livermore Lab.
CALCULATION OF THE CORRECTED TEMPERATURE RISE FOR ISOPERIBOL LASER CALORIMETERS
Stuart R. Gunn 11 Feb. 1976 21 p refs
(Contract W-7405-eng-48)
(UCRL-52019) Avail: NTIS HC A02/MF A01

The assumptions involved in the singlebody calorimeter model were discussed, and procedures for rigorous calculation of the corrected temperature rise were given. Electrical-heating and irradiation measurements with several calorimeters were used to illustrate the magnitude of errors introduced by simple linear extrapolation procedures. Effects of linear and curved baseline drifts were considered. Computed heating curves were compared with those observed. ERA

N77-17451# California Univ., Livermore. Lawrence Livermore Lab.
EFFECTS OF ENVIRONMENTAL PERTURBATIONS ON LASER-BEAM CALORIMETERS
Stuart R. Gunn 11 Feb. 1976 20 p refs
(Contract W-7405-eng-48)
(UCRL-52018) Avail: NTIS HC A02/MF A01

A series of tests was made of the response of laser beam calorimeters to changes in infrared and visible radiation backgrounds, to air currents, and to changes in jacket temperature. The calorimeters were for most purposes adequately stable with respect to reasonable changes in ambient temperature. ERA

N77-17452# Sandia Labs., Albuquerque, N.Mex.
EXPERIMENTAL APPARATUS FOR MEASURING CROSS SECTIONS OF IMPORTANCE TO NUCLEAR PUMPING
G. J. Lockwood and G. H. Miller 1976 10 p refs Presented at Workshop on Nucl. Pumped Laser, Monterey, Calif., 6 Apr. 1976 Sponsored by ERDA
(SAND-76-5338; Conf-760438-2) Avail: NTIS HC A02/MF A01

Recent success in pumping a CO vibrational-rotational transition laser by fission products has raised questions concerning the excitation mechanisms. There appear to be at least three possible processes. First, the energetic fission fragments may produce vibrational-rotational excitation directly in collisions. Second, they may produce electrons by ionization, and these electrons may then produce excitation. The third process is similar to the second, with the fission products producing energetic recoil ions, which then collisionally excite the CO. Some indirect arguments are put forth that the first and third processes combined are indeed quite significant, although the second undoubtedly is the most important. ERA

N77-17453# Los Alamos Scientific Lab., N.Mex.
NUMERICAL RATE EQUATION MODEL FOR THE He-Cs CHARGE EXCHANGE LASER
John F. Seely Mar. 1976 13 p refs
(Contract W-7405-eng-36)
(LA-6298-MS) Avail: NTIS HC A02/MF A01

A model for the He-Cs charge exchange laser was formulated in which the coupled photon and particle rate equations were solved numerically for the laser intensities at 584 A and 2 micron. The photo rate equations included spontaneous and stimulated emission and photoabsorption processes. The particle rate equations included charge exchange, electron impact excitation and ionization, spontaneous and stimulated emission, photoabsorption, and all appropriate back reactions. Input parameters included initial particle densities and temperatures, shapes of the leading edges of the helium plasma and target, relative drift velocity of the plasma and target, and laser length. The laser intensities were calculated as functions of time, depth into the target, and position along the laser axis. ERA

N77-17454# Illinois Univ., Urbana.
DIRECT NUCLEAR PUMPED (DNP) LASERS
G. H. Miley and W. E. Wells 1976 6 p refs Presented at the Intern. Conf. on Quantum Electronics and Exhibition, Amsterdam, 14 Jun. 1976 Sponsored by ERDA
(COO-2007-71P; Conf-760611-2) Avail: NTIS HC A02/MF A01

The direct nuclear pumped (DNP) lasers and the available Megajoules of pumping energy suggest the possibility of DNP high-power lasers. These studies relate the DNP electron distribution to ionization, recombination, charge exchange, and eximer formation. ERA

N77-17455# Sandia Labs., Albuquerque, N.Mex.
FEASIBILITY STUDY RELATING TO THE USE OF HIGH GAIN LASERS, PARTICULARLY HF, IN CONTROLLED FUSION APPLICATIONS
Michel A. Duguay, George A. Fisk, James M. Hoffman, James B. Moreno, Richard E. Palmer, Merle E. Riley, and Robert P. Sandoval Mar. 1976 133 p refs
(Contract AT(29-1)-789)
(SAND-76-0094) Avail: NTIS HC A07/MF A01

The two systems considered were HF and KrF, with by far the predominant effort being expended on HF. A short discussion of KrF is presented. Many of the problems discussed in the context of HF are general even though the solutions may be specific to HF. An outline of design constraints is presented, including pellet irradiation criteria, HF-system characteristics, and material damage thresholds. Several potentially useful techniques are considered for handling high-gain lasers. Angular multiplexing in the final stage of an HF system is considered as the scheme most likely to succeed. Several possible goemetries for the final amplifier are considered and one is chosen for further study. Detailed model calculations were performed for the prototype HF amplifier. The input power required to suppress ASE, amplifier gain as a function of input power, and the problem of transverse ASE are addressed. A prototype multikilojoule HF laser with on-target pulse duration of 1 ns is described. ERA

N77-17456# California Univ., Livermore. Lawrence Livermore Lab.
LASER LIGHT ABSORPTION DUE TO SELF-GENERATED MAGNETIC FIELDS
W. L. Kruer and K. G. Estabrook 20 Apr. 1976 14 p refs Presented at the Spring meeting of the Am. Phys. Soc., Washington, D. C., 26 Apr. 1976
(Contract W-7405-eng-48)
(UCRL-77717; Conf-760431-2) Avail: NTIS HC A02/MF A01

It is shown that even normally incident laser light will be resonantly absorbed near the critical density surface when there are self-generated dc magnetic fields. Theoretical estimates for the coupling mechanism, saturation amplitudes, and absorption are given and tested in computer simulations for parameters characteristic of some recent laser-plasma experiments. ERA

N77-17457# Hughes Research Labs., Malibu, Calif.
THE 10.6 MICRON PARAMETRIC FREQUENCY CONVERTER Semiannual Technical Report, 1 Nov. 1975 - 30 Apr. 1976
C. K. Asawa, T. K. Plant, and R. L. Abrams 30 May 1976 73 p refs
(Contract N00014-75-C-0089; ARPA Order 1906)
(AD-A028806; SATR-3) Avail: NTIS HC A04/MF A01 CSCL 20/6

The first observation of resonantly-enhanced Stark-induced two-photon mixing in a gas was previously reported on this program. Parametric single sideband generation in N(14)H2D at the difference frequency of 10.6 micrometers and 4 GHz microwave radiation was described. During this reporting period, exact confirmation of the theoretical prediction of conversion efficiency versus gas pressure was established by new precision measurements of the N(14)H2D absorption linewidth versus pressure. Two new parametric converter systems that promise increased parametric gain and conversion efficiency (several times to two orders of magnitude) have been identified. These are: (1) the C(12)O2(16) P(26) laser line and 2.15 GHz microwave radiation resonating with the Stark tuned vibrational-rotational transitions of N(15)H2D and (2) the isotopic C(13)O2(16) R(18)

laser line and 26.378 GHz microwave radiation resonating with N(14)H3. The basis for the increased gain is described. GRA

N77-17458# Dayton Univ. Research Inst., Ohio.
ULTRA-PRECISION PHOTOMETRY OF AR COATINGS
D. D. Preonas Jul. 1976 10 p Presented at the 5th Laser Window Conf., Las Vegas, Nev., Dec. 1975; sponsored by ARPA
(Contract F29601-75-C-0031)
(AD-A028712; AFWL-TR-76-504) Avail: NTIS HC A02/MF A01 CSCL 20/6

The configuration of the AFWL Laser Window Test Apparatus (LWTA) has been modified so that ultra-high precision scans can be made to determine the spacial variations in the reflection of anti-reflective (AR) coatings and other low reflection specimens, such as low efficiency gratings for lasers. The LWTA consists of a computer-controlled rastering device used to position specimens with respect to two stationary CO2 laser probing beams -- one for photometry and one for interferometry. Data are gathered and processed by an on-line computer, are presented to the operator, and are written out on magnetic tape for further analysis. Typically, from 500 to 50,000 points are gathered per specimen, depending upon the spacial precision required. This paper addresses a modification to the LWTA photometer in which the measurement of specimen transmission and attenuation has been sacrificed to obtain a 15-fold improvement in the measurement of specimen reflection. GRA

N77-17459# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LASER HEATING OF METALLIC SURFACES
Stephen Marcus, J. Elbert Lowder, Scott K. Manlief, and Daniel L. Mooney 20 May 1976 44 p refs
(Contract F19628-76-C-0002; ARPA Order 600)
(AD-A028580; LTP-31; ESD-TR-76-122) Avail: NTIS HC A03/MF A01 CSCL 20/6

Thermal coupling of pulsed 10.6 micrometer laser radiation to aluminum, copper, and titanium targets has been measured as a function of incident fluence focal spot size, and ambient pressure, using both calorimetric and fast-response surface-thermocouple techniques. A peak enhancement in thermal coupling of approximately a factor of ten was observed to occur at the onset of a well-developed plasma at the surfaces of the copper and aluminum targets. After passing through a maximum, the enhanced coupling decreased with increasing fluence and approached CW values at high incident laser fluences. For small spot sizes (area approximately equal to, or less than 0.03 sq cm), most of the enhanced absorption occurred outside the focal spot. The fraction of energy coupled to the target within the focal spot increased with increasing spot size. Under conditions of low ambient pressure (approximately 0.5 torr), the breakdown threshold was increased by a factor of 5, and at high incident fluences the thermal coupling for aluminum was roughly a factor of 2 higher than at atmospheric pressure. GRA

N77-17460# Perkin-Elmer Corp., Norwalk, Conn. Electro-Optical Div.
MODAL WAVEFRONT CONTROL SYSTEM (MOWACS) Final Report, 2 Aug. 1975 - Jul. 1976
C. Neufeld 2 Jul. 1976 91 p
(Contract N60921-75-C-0148)
(AD-A028298; PE-13039) Avail: NTIS HC A05/MF A01 CSCL 20/6

MOWACS (Modal Wavefront Control System) is a form of Coherent Optical Adaptive Techniques (COAT) used to obtain information required to correct turbulence and thermal blooming aberrations characteristic of high energy lasers in the atmosphere. The feasibility of replacing complex multi-segment mirror COAT systems with continuously deformable mirrors was established in Phase I. In Phase II the system was upgraded to include a 100 Hz bandwidth closed loop system and to allow the introduction of more sophisticated aberrations. GRA

N77-17461# American Airlines, Inc., Ft. Worth, Tex.
SCANNED LASER VISUAL SYSTEM FEASIBILITY STUDY Final Report
A. M. Spooner (Redifon Flight Simulation Ltd., London), D. R. Lobb (British Sci. Instrument Res. Assoc.), and R. A. Waldrop 23 May 1976 188 p refs
(Contract N61339-76-C-0018; DA Proj. 1Y7-62716-AH-70)
(AD-A029054; PM-TRADE-TR-76-0001) Avail: NTIS HC A09/MF A01 CSCL 01/4

This report outlines the general visual simulation requirements for military fixed wing and rotary wing attack aircraft. Reference is made to previous approaches to wide-angle visual simulation systems with rationale for choosing the proposed scanned laser visual system approach. The scanned laser visual system utilizes laser beams to scan a terrain model board and a spherical display screen over a 175 deg horizontal by 60 deg vertical field of view with 5-arc minutes image resolution. A detailed description and a set of performance parameters are provided for the proposed system. Problem areas in constructing the proposed system are identified and discussed. In the discussion of problem areas, reference is made to existing technology relevant to the proposed system, a collection of information from vendors of required components, past experimental work and a theoretical analysis of the optical design aspects of possible alternate design approaches. Author (GRA)

N77-17462# Naval Electronics Lab. Center, San Diego, Calif.
CO2 COHERENT PROPAGATION (WITH RECIPROCAL TRACKING) THROUGH THE MARINE BOUNDARY LAYER. EXPERIMENTAL MEASURES OF ATTENUATION, SCINTILLATION, WAVEFRONT, TILT, AND COHERENCE ARE MADE THROUGH CLEAR AIR, FOG, AND HAZE Research Report, Jan. - Jun. 1976
R. J. Giannaris, G. C. Mooradian, and W. R. Stone 28 Jun. 1976 70 p refs
(NELC Proj. J425)
(AD-A029718; NELC-TR-1994) Avail: NTIS HC A04/MF A01 CSCL 17/2

Two CO2 heterodyne receivers, each utilizing wave-front tilt tracking derived from the nutation of the received signal over the detector, are used to measure propagation effects through a marine environment over an 18.2-km path across the San Diego harbor inlet. Measurements of attenuation, characterized as signal loss; scintillation, characterized as percent modulation; wavefront tilt, characterized as angle-of-arrival spectra; and coherence, characterized by the angular brightness function, are made through clear air, haze, and fog. It is determined that reciprocal tracking provides significant enhancement to signal levels under all propagation conditions whereas single-station tracking does not. The dominance of a theoretically predicted coherent direct beam propagating through scattering media is observed. The data are correlated with meteorological data obtained from three points along and adjacent to the path. Author (GRA)

N77-17298# Osaka Univ. (Japan). Dept. of Electrical Engineering.
CHARACTERISTICS OF InSb SPIN-FLIP RAMAN LASER PUMPED BY A TE CO2 LASER
Hideo Takamatsu, Kazuhito Yasuda, Junji Shirafuji, and Yoshio Inuishi *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 437-444 refs (For primary document see N77-17291 08-31)
(Rept-1316) Avail: NTIS HC A10/MF A01

N77-17301# Osaka Univ. (Japan). Dept. of Electrical Engineering.
LASER-INDUCED BREAKDOWN IN ORGANIC LIQUID
Haruhisa Fujii, Katsumi Yoshino, and Yoshio Inuishi *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 461-470 refs (For primary document see N77-17291 08-31)
(Rept-1319) Avail: NTIS HC A10/MF A01

N77-17303# Osaka Univ. (Japan). Dept. of Electrical Engineering.
INTERACTION OF TEA CO2 LASER LIGHT WITH LASER PRODUCED PLASMA
Chobei Yamabe (Nagoya Univ.), Eiji Setoyama, Hisayoshi Nakakita, Akira Miyazaki, Aye Thein, Yoneyoshi Kitagawa, Masahiro Yokoyama, and Chiyoe Yamanaka *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 477-486 refs (For primary document see N77-17291 08-31)
(Rept-1321) Avail: NTIS HC A10/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-17463 Cincinnati Univ., Ohio.
FRICTION AND WEAR STUDIES ON POLYETHYLENE TEREPHTHALATE Ph.D. Thesis
Lily Chen Tu 1976 184 p
Avail: Univ. Microfilms Order No. 76-29952

The mechanisms of friction and wear of polyethylene terephthalate (PET) film is carried out by a reciprocating wear tester. Measurements were made on amorphous PET film, uniaxially oriented PET film and crystalline PET film. Coefficients of friction were measured as a function of normal load, crystallinity, and draw ratio at constant sliding speed. Wear volume was measured as a function of sliding distance, crystallinity and draw ratio at constant sliding speed and normal load. The experimental results of crystalline PET samples and of oriented samples were compared with the experimental results of amorphous PET samples. The effects of crystallinity and cold-draw on the mechanical properties as well as friction and wear properties were discussed. The results of these experiments show that there is correlation between the structure of the sample and the mechanical properties of the sample. Dissert. Abstr.

N77-17464* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC BEARING SYSTEM Patent
Philip A. Studer, inventor (to NASA) Issued 4 Jan. 1977 13 p Filed 3 Jul. 1975 Supersedes N75-27386 (13 - 18, p 2256)
(NASA-Case-GSC-11978-1; US-Patent-4,000,929; US-Patent-Appl-SN-593142; US-Patent-Class-308-10) Avail: US Patent Office CSCL 13I

A single magnetic, radial bearing having a disc with an axis coincident with the bearing or shaft axis is described. The bearing passively supports an annulus which forms a radial gap between its inner circumferential edge and the circumferential edge of the disc. The disc has a relatively large diameter compared to its length along the axis.
Official Gazette, of the U.S. Patent Office

N77-17465*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RECERTIFICATION OF THE AIR AND METHANE STORAGE VESSELS AT THE LANGLEY 8-FOOT HIGH-TEMPERATURE STRUCTURES TUNNEL
C. Michael Hudson, Robert L. Girouard, Clarence P. Young, Jr., Dennis H. Petley, John L. Hudson, Jr., and James L. Hudgins Feb. 1977 77 p refs
(NASA-TN-D-8329; L-11015) Avail: NTIS HC A05/MF A01

This center operates a number of sophisticated wind tunnels in order to fulfill the needs of its researchers. Compressed air, which is kept in steel storage vessels, is used to power many of these tunnels. Some of these vessels have been in use for many years, and Langley is currently recertifying these vessels to insure their continued structural integrity. One of the first facilities to be recertified under this program was the Langley 8-foot high-temperature structures tunnel. This recertification involved (1) modification, hydrotesting, and inspection of the vessels; (2) repair of all relevant defects; (3) comparison of the original design of the vessel with the current design criteria of Section 8, Division 2, of the 1974 ASME Boiler and Pressure Vessel Code; (4) fracture-mechanics, thermal, and wind-induced vibration analyses of the vessels; and (5) development of operating envelopes and a future inspection plan for the vessels. Following these modifications, analyses, and tests, the vessels were recertified for operation at full design pressure (41.4 MPa (6000 psi)) within the operating envelope developed. Author

N77-17466*# National Aeronautics and Space Administration. Pasadena Office, Calif.
IMPROVED NOZZLE FOR USE WITH ABRASIVE AND/OR CORROSIVE MATERIALS Patent Application
Gerald S. Perkins (JPL), Eugene V. Pawlik (JPL), and Wayne M. Phillips, inventors (to NASA) (JPL) Filed 17 Feb. 1976 25 p (Contract NAS7-100)
(NASA-Case-NPO-13823-1; US-Patent-Appl-SN-658487) Avail: NTIS HC A02/MF A01 CSCL 13I

A nozzle composed of sintered ceramic materials having high temperature oxidation resistance, high hardness and high abrasion and corrosion resistance is described. The ceramic may be a binary solid solution of a ceramic oxide and silicon nitride, or preferably a ternary solid solution of a ceramic oxide, silicon nitride and aluminum nitride. The ceramic oxide is selected from a group consisting of Al_2O_3, Y_2O_3 and Cr_2O_3, or mixtures thereof. Titanium carbide particles are dispersed in the ceramic mixture before sintering. The nozzles are encased for protection from external forces while in use by a metal or plastic casing.
NASA

N77-17467*# National Aeronautics and Space Administration. Pasadena Office, Calif.
IMPROVEMENT IN COMBUSTION ENGINE Patent Application
John Houseman, inventor (to NASA) (JPL) Filed 2 Apr. 1975 21 p
(Contract NAS7-100)
(NASA-Case-NPO-13671-1; US-Patent-Appl-SN-564622) Avail: NTIS HC A02/MF A01 CSCL 21A

An internal combustion engine is described in which one or more of the cylinders of the engine are used for generating hydrogen rich gases from hydrocarbon fuels. These gases are then mixed with air and injected into the remaining cylinders to be used as fuel. When heavy load conditions are encountered, hydrocarbon fuel may be mixed with the hydrogen rich gases and air and the mixture injected into the remaining cylinders as fuel.
NASA

N77-17468# Technische Hogeschool, Delft (Netherlands).
DESIGN OF A HIGH-SPEED CYLINDRICAL GRINDING MACHINE Ph.D. Thesis
Ir. T. Storm Jun. 1976 139 p refs
(WTHD-80) Avail: NTIS HC A07/MF A01

The design of a high speed cylindrical grinding machine is described. capable of machining shafts with a maximum length of 750 mm and a maximum diameter of 250 mm at a metal removal rate of 20,000 cu mm/s and a wheel speed of 150 m/s. The grinding spindle is driven directly without any transmission a special hydraulic motor with a maximum power of 150 kW at a speed of 10,000 rpm. The machine structure supports the grinding spindle and the workpiece. The main requirement for the structure is the maximum deformation that is allowed with regard to the accuracy of the workpiece. In order to calculate the deformation of the structure a finite element program is applied. The drives of the slide, the wheel head and the workpiece, and the control of the machine are discussed. The drive motors that are applied are electrical stepping motors, which result in a relatively simple control system. This control system achieves the movements of the grinding wheel relative to the workpiece according to the workpiece geometry. The control system also provides the correct conditions for the grinding process. Some secondary aspects of the design are discussed.
Author

N77-17469# Technische Hogeschool, Delft (Netherlands).
A CONTRIBUTION TO THE IMPROVEMENT OF COMPRESSOR VALVE DESIGN Ph.D. Thesis
S. Touber Jul. 1976 208 p refs
(WTHD-84) Avail: NTIS HC A10/MF A01

Methods are given for designing a reciprocating compressor valve which permits stable dynamic behavior at relatively low levels of pressure drop. Factors influencing the behavior and flow resistance of a compressor valve were analyzed. Quantitative means were developed to correct the balancing of these factors, to obtain an optimal solution. A compressor simulator was used for theoretical prediction of valve plate motion, compressor throughput and the power absorbed. Author

N77-17470# Technische Hogeschool, Delft (Netherlands).
WHEELWEAR CONTROL IN GRINDING: MODELS FOR THE CONTROL OF WHEELWEAR, GRINDING FORCE AND SURFACE ROUGHNESS BY THE CHOICE OF DRESSING AND GRINDING CONDITIONS Ph.D. Thesis
J. Verkerk Jul. 1976 138 p refs

(WTHD-81) Avail: NTIS HC A07/MF A01

The effects of dressing and grinding conditions on the change of microgeometry of the wheel surface are investigated. The impact on the macrogeometry of the wheel surface in plunge grinding is also determined. A wear model is described which makes it possible to transfer plunge grinding test results to traverse grinding, in order to obtain a quantitative indication of how the traverse grinding process can be controlled. The model shows how wheelwear develops, and how it affects the shape of the workpiece, the grinding force and the worksurface roughness. The axial wear rate of the wheel profile is controlled by means of the depth of cut, the feed per revolution and the workspeed. The choice of the dimensions of the wheel has also a considerable effect on the radial wear rate. Author

N77-17471# Oak Ridge National Lab., Tenn.

INVESTIGATION OF A PERFUSION IMPACTION DUST SEPARATOR

G. L. MacWilliam, F. Gutierrez, and A. S. Lee 26 Sep. 1975 47 p refs Sponsored by ERDA

(ORNL/MIT-215) Avail: NTIS HC A03/MF A01

Collection efficiency of an impaction dust separator, with a porous plate as the impaction surface, was investigated theoretically and experimentally. To provide continuous removal of deposited material, water perfused through the plate in a direction opposite to the impaction direction. The determination of theoretical collection efficiencies as a function of particle and jet properties was attempted by analyzing the governing equations. Experimental collection efficiency was measured for an aerosol jet of organic liquid particles in air. ERA

N77-17472# Oak Ridge National Lab., Tenn.

LABORATORY SERVICES SERIES: A LUBRICATION PROGRAM

H. B. Bowen and T. L. Miller May 1976 38 p refs

(Contract W-7405-eng-26)

(ORNL-TM-5426) Avail: NTIS HC A02/MF A01

The diversity of equipment and operating conditions at a major national research and development laboratory, and its requirement of a systematic, effective lubrication program, is discussed. The various phases of this program and the techniques employed in formulating and administering this program are discussed under the following topics: equipment identification, lubrication requirements, assortment of lubricants, personnel, and scheduling. ERA

N77-17473# Oak Ridge Y-12 Plant, Tenn.

WORKPIECE FIXTURING USING RUBBER COMPOUNDS

O. T. Gibson Apr. 1976 16 p refs Presented at the 5th Seminar on Practical Appl. in Mfg., Gatlinburg, Tenn., 23 Apr. 1976

(Contract W-7405-eng-26)

(Y-DA-6740; Conf-760468-3) Avail: NTIS HC A02/MF A01

A workpiece (part) support method referred to as potting the part was developed that minimizes the distortion introduced by conventional fixturing. Conventional fixtures, such as vacuum chucks distort workpieces by forcing an out-of-round part to conform to the round contour in the vacuum fixture. The workpiece is machined round and then goes out of round when it is removed from the fixture. Multijaw chucks distort parts by the application of concentrated forces at the chuck jaws. The use of potting fixtures minimizes this distortion by extruding a two-part castable rubber in a gap (approximaterly 30 mils) between the workpiece and fixture and allowing the rubber to cure while holding the workpiece in its free state. The use of the method for fabrication of large laser mirrors is briefly illustrated. ERA

N77-17474# Mound Lab., Miamisburg, Ohio.

SEMIAUTOMATIC MDF DEBURRING TOOL

W. L. Simonton 31 Mar. 1976 9 p

(Contract E(33-1)-gen-53)

(MLM-2310) Avail: NTIS HC A02/MF A01

A device for semiautomatically deburring the ends of lengths of mild detonating fuse (MDF) by cutting a 0.002 in. x 0.002 in. chamfer on the MDF with small rotating blades is described. This air-operated, semiautomatic device provides improvement over the manual method of removing burrs by reduction in time and operator strain. ERA

N77-17475# Mound Lab., Miamisburg, Ohio.

MODIFICATIONS RESULTING IN SIGNIFICANT INCREASES IN THE BEAM USAGE TIME OF A 60 keV ELECTRON BEAM WELDER

Ronald E. Zielinski and James L. Harrison 17 May 1976 12 p

(Contract E(33-1)-gen-53)

(MLM-2314) Avail: NTIS HC A02/MF A01

Short beam usage times were encountered using a 60 keV electron beam welder. These short times were the direct result of a buildup of a reaction product that occurred on graphite washers which housed the tungsten emitter plate. While it was not possible to prevent the reaction product, its growth rate was sufficiently altered by changing graphite materials and minor design changes of the washers. With these modifications, beam usage times increased from an original 40 min to approximately 675 min. ERA

N77-17476# California Univ., Livermore. Lawrence Livermore Lab.

THERMAL CENTERING OF A FUSION WELD WITH A SCANNING RADIATION THERMOMETER

H. S. Freynik, Jr. and J. A. Arluck 9 Mar. 1976 39 p refs

(Contract W-7405-eng-48)

(UCRL-52033) Avail: NTIS HC A03/MF A01

To determine whether the scanner could measure small asymmetries of the thermal profile, a series of first pass welds were made on one-piece ungrooved test parts. Midway in each pass, the weld head was deliberately offset (jogged). By scanning across the weld line 10 mm in front of the arc, the relative temperature distribution was inferred from the measured radiosity profile along the scan line. In principle, the thermal peak location on the scan line coincided with the thermal peak location at the arc, after a small time delay. Deliberate jogs of 0.86 mm were measured by the scanner and confirmed by a displacement transducer. ERA

N77-17477# California Univ., Livermore. Lawrence Livermore Lab.

MODIFICATION OF A HARDWIRED NUMERICAL CONTROL TO INCLUDE SWITCHABLE INCH/METRIC CAPABILITY

L. E. Newton 23 Apr. 1976 15 p refs

(Contract W-7405-eng-48)

(UCID-17119) Avail: NTIS HC A02/MF A01

A unique and relatively simple method is described for modifying a 1965-vintage hardwired numerical control (N/C) for a machine tool so that it can operate in the SI (metric) as well as the inch mode. The modification procedure will be valuable during the transition from Inch to SI measurements, as it allows a numerically-controlled machine tool originally designed to operate only in the inch mode to be recycled for SI use. The modified system thus allows selection of either the SI operating mode or the inch mode by a front panel switch. ERA

N77-17478# Oak Ridge Y-12 Plant, Tenn.

PRODUCTION APPLICATIONS OF AIR BEARINGS

P. J. Steger and W. H. Rasnick 16 Apr. 1976 15 p refs Presented at Region 5 Seminar on Pract. Appl. in Manufacturing, Gatlinburg, Tenn., 23 Apr. 1976; sponsored by Soc. of Manufacturing Engr.

(Contract W-7405-eng-26)

(Y-DA-6687; Conf-760468-4) Avail: NTIS HC A02/MF A01

Air bearings are shown to be production viable, offering many advantages when applied prudently. Particular emphasis is placed on the porous graphite, externally pressurized air bearing, the type offering the most promising and reliable operation for most applications. ERA

N77-17479# Bendix Corp., Kansas City, Mo.

GROUP TECHNOLOGY

C. P. Rome Jan. 1976 69 p refs Presented at CAM-1 Coding and Classification Workshop, St. Louis, 20 Jan. 1976

(Contract AT(29-1)-613)

(BDX-613-1478) Avail: NTIS HC A04/MF A01

A manufacturing philosophy directed toward increasing batch-lot production efficiency was conceptually applied to the manufacture of batch-lots of 554 machined electromechanical parts which now require 79 different types of metal-removal

tools. The products are grouped into 7 distinct families which require from 8 to 22 machines in each machine-cell. Throughput time can be significantly reduced, and savings can be realized from tooling, direct-labor, and indirect-labor costs. ERA

N77-17480# Oak Ridge Y-12 Plant, Tenn.
JOINING URANIUM TO STEEL
M. A. Perkins May 1976 22 p refs
(Contract W-7405-eng-26)
(Y-2041) Avail: NTIS HC A02/MF A01

A method has been devised which will allow the joining of uranium to steel by fusion welding through the use of an intermediate material. Uranium-0.5 titanium was joined to stainless steel by using a vanadium insert. Also, a method is now available for selecting possible filler metals when two entirely dissimilar metals need to be joined. This method allows a quantitative ranking to be made of the possible filler metals and thus the most likely candidate can be selected. ERA

N77-17481# United Technologies Research Center, East Hartford, Conn.
APPLICATION OF COMPOSITE BEARINGLESS ROTOR CONCEPT TO WIND TURBINE ROTOR Progress Report, 3 Jun. - 31 Oct. 1975
P. A. M. Spierings and M. C. Cheney 1 Dec. 1975 25 p
(Contract E(11-1)-2614)
(COO-2614-1) Avail: NTIS HC A02/MF A01

The feasibility of the composite bearingless rotor (CBR) for use as a wind turbine is explored. Several automatic control concepts designed to improve efficiency and cost effectiveness are evaluated. The full scale wind turbine and scale model designs are described. The performance characteristics expected of the wind turbine are reviewed. Wind tunnel experiments and analytical studies are outlined. Appendices are included to provide detailed information on some of the design characteristics of the model wind turbine. ERA

N77-17482# California Univ., Livermore. Lawrence Livermore Lab.
THREE DIMENSIONAL NUMERICAL MODELING OF LIQUID FUEL SPRAYS
Charles K. Westbrook Apr. 1976 29 p refs Presented at the 16th Intern. Symp. on Combustion, Cambridge, Mass., 15 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-77621; Conf-760801-1) Avail: NTIS HC A03/MF A01

A numerical solution technique was developed for the spray equation and was applied to thin sprays injected into a type of stratified charge internal combustion chamber. The difference equation method can treat general three dimensional geometries using a statistical approach. The effects of independent variations of a large number of system parameters was studied, including initial spray dispersion, amount and type of gas swirl, gas density, injection timing, chamber geometry, initial droplet size distribution, injection velocity, drag coefficient, vaporization rate expression, injector aperture size, droplet specific gravity, and direction of injection. It was found that in the particular geometry chosen the gas swirl, the droplet size distribution produced by the injector, and the chamber gas density into which the spray is injected are the most important factors influencing the spray motion and vaporization. ERA

N77-17483# Forschungskuratorium Maschinenbau e.V., Frankfurt am Main (West Germany).
TRIBOLOGY: FRICTION, WEAR, LUBRICATION Final Report
Hermann Boer (August-Thyssen-Huette A. G.), Georg Graue (Ges. fuer Tribologie e. V.), Peter Greis (Ver. Deut. Eisenhuettenwerke A. G.), Eugen Guelker (Hoesch Huettenwerke A. G.), Guenther Heinke (Bosch (Robert) G.m.b.H., Stuttgart), Werner-Hans Kara (Deut. Shell A. G.), Otto Lang (Daimler-Benz A. G.), Heinz Peeken (Tech. Hochschule, Aachen), Erich Pollmann (Kraftwerk Union A. G.), Erich Roemer (Daelen & Loos G.m.b.H.) et al Bonn Bundesmin. fuer Forsch. u. Technol. Jul. 1976 282 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NTS-54)
(BMFT-FB-T-76-38) Avail: NTIS HC A13/MF A01; ZLDI, Munich, DM 58,80

The economic significance of tribology is dealt with, and the state-of-the-art in the fields of friction, wear, and lubrication in the Federal Republic of Germany is presented. Dry, boundary, and lubricated friction are discussed, as well as a number of special problems with overlapping significance in connection with the system components, material and lubricant. The tribological aspect of metal working, design, and maintenance are considered. Tribotechnical measuring and testing techniques are described. A number of research and development projects in the field are proposed. ESA

N77-17484# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
HIGH POWER STUDY-TURBINE DRIVE SYSTEMS. VOLUME 1: ANALYTICAL PROGRAM Final Report, 2 Jun. 1975 - 1 Mar. 1976
R. L. Binsley Wright-Patterson AFB, Ohio AFAPL May 1976 110 p refs
(Contract F33615-75-C-2072; AF Proj. 3145)
(AD-A027414; R-9889-Vol-1; AFAPL-TR-76-10-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 21/5

This final report describes the results of a study of turbine drive systems for high power (10 to 50 MW) airborne power units. Propellant selection, system type selection, and turbine selection are analyzed. A computer program to calculate weight and volume of selected systems is described. Results of parametric analyses and specific point designs are presented. Author (GRA)

N77-17485# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.
THE EFFECT OF AIRCRAFT GAS TURBINE ENGINE LUBRICANTS ON ROLLING/SLIDING CONTACT FATIGUE Final Report
R. Valori Jun. 1976 62 p refs
(AD-A028295; NAPTC-PE-85) Avail: NTIS HC A04/MF A01 CSCL 11/8

Contact fatigue testing under conditions of both pure rolling and rolling with sliding were conducted on various lubricants and additives. Principal findings were that: (a) perfluoroalkylpolyethers, C-ethers and a synthetic hydrocarbon traction fluid were all found to improve contact fatigue life over oils conforming to the MIL-L-23699B specification (i.e. polyol esters); (b) a phosphorous salt high gear loading additive was found to be detrimental to fatigue life; (c) micropitting is a precursor to fatigue spalling when sliding is present; (d) fatigue life decreases dramatically with increasing sliding velocity and increases with increasing rolling velocity, and (e) additives are most effective when sliding is present. GRA

N77-17486# Combustion Engineering, Inc., Chattanooga, Tenn. Welding Engineering Dept.
WELD REPAIR OF HEAVY SECTION STEEL TECHNOLOGY PROGRAM VESSEL V-7 Final Report
W. D. Goins and D. L. Butler Aug. 1976 70 p refs Sponsored by EPRI
(PB-257568/6; EPRI-NP-179) Avail: NTIS HC A04/MF A01 CSCL 18J

The Heavy Section Steel Technology (HSST) Program has been pressure-testing intermediate sized vessels roughly scaled to nuclear reactor pressure vessels. One such vessel, ITV-7, intentionally flawed in the axial direction, was hydraulically pressurized to failure - leakage occurred when the vessel was pressurized to 2 1/2 times the design pressure. Arrangements were made with the HSST Program office to use this vessel for the purpose of repairing the thru wall flaw. The repair was performed to demonstrate the utility of such a weld repair. Details of the procedures used with that repair are reported. GRA

N77-17487# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Electrical Engineering.
IN-PROCESS OPTICAL GAUGING FOR NUMERICAL MACHINE TOOL CONTROL AND AUTOMATED PROCESSES Progress Report, Nov. 1975 - May 1976
H. W. Mergler and L. Case May 1976 40 p refs
(Grant NSF APR-75-00216)
(PB-257026/5; NSF/RA-760167; PR-2) Avail: NTIS

HC A03/MF A01 CSCL 13H

The loop closure was assessed by monitoring, by laser optical techniques, the dimension of the actual workpiece as close as possible to the point of contact of the cutting tool so that all machine errors were within the control loop. A solution was proposed to the measurement/control problem that involved the use of a small He-Ne laser source chopped into two phase-orthogonal signals and focused at fixed incident angles at a common point on the workpiece surface. GRA

N77-17488# Avco Lycoming Div., Stratford, Conn.
WELDED ROTOR INSPECTION DEVELOPMENT PROJECT T55-J-027 Final Report, 1 Jun. 1975 - 15 Mar. 1976
Sushiel Jain, Victor Strautman, and Paul Iodon 15 Mar. 1976 65 p
(Contract DAAJ01-75-C-0339)
(AD-A028246; LYC-76-16; USAAVSCOM-TR-76-38) Avail: NTIS HC A04/MF A01 CSCL 14/2

The results of this project show that the pulse-echo techniques used in ultrasonic testing offer the best resolution and flow detectability on a welded rotor shaft. Based on these results, detailed procedures have been established defining acceptance criteria and equipment used. This project also showed that these techniques can be used for field inspection. The feasibility of using acoustic emission inspection techniques as an inspection tool for the welded rotor using a low cycle fatigue load for stress inducement was demonstrated. Author (GRA)

N77-17489# Raytheon Co., Waltham, Mass. Research Div.
MANUFACTURING METHODS AND TECHNOLOGY MEASURE FOR ARC PLASMA SPRAYED PHASE SHIFTER ELEMENTS Quarterly Progress Report, 1 Apr. - 30 Jun. 1976
H. J. VanHook, D. Masse, and Joseph H. Saunders Jul. 1976 46 p
(Contract DAAB07-75-C-0043)
(AD-A028754; S-2061; QPR-4) Avail: NTIS HC A03/MF A01 CSCL 09/5

Data on plasma spray conditions are discussed for seventy-one APS samples produced during this quarter. Spray deposition and sample transfer rates of one full length phase shifter every twelve minutes was obtained with a high velocity plasma gun assembly, but the samples showed cracks in the ferrite layer. We have established the source and corrected a major cause of this cracking by changing the anode geometry on the arc plasma gun. Microwave and hysteresis loop properties are reported on a number of APS prepared samples. Because of the cracking problem the saturation phase shift is low approximately 300 deg per full length sample; the insertion loss remains low less than 0.5 dB despite the presence of cracks. Author (GRA)

N77-17490# Minicars, Inc., Goleta, Calif.
CRASHWORTHINESS OF THE SUBCOMPACT VEHICLE Final Report, Jun. 1973 - Oct. 1975
Richard B. Tanner Aug. 1976 298 p
(Contract Dot-HS-113-3-746)
(PB-258293/0; DOT-HS-801-969) Avail: NTIS HC A13/MF A01

The crashworthiness of subcompact vehicles both analytically and experimentally is examined. Statistical accident analysis and dynamic response modelling are studied analytically. Experimental testing to determine baseline performance consisted of ten dynamic impacts at various angles and velocities. The 1974 production Pinto sedan provided adequate crashworthiness for 40 mph BEV aligned frontal impacts, 30 mph BEV offset and oblique frontal impacts, and 12 mph BEV side impacts. A modified design was developed which improved the crashworthiness in the most significant modes. Specifically, the modified design provides safety in the frontal aligned mode to at least 50 mph BEV, in the offset and oblique modes to at least 50 mph, and in the side impact mode to at least 30 mph. GRA

N77-17491# National Highway Traffic Safety Administration, Washington, D. C. Safety Research Lab.
AIR BRAKED VEHICLE PERFORMANCE: FMVSS NO. 121 BRAKING SYSTEMS VERSUS PRE-FMVSS NO. 121 BRAKING SYSTEMS AND STABILITY AUGMENTATION DEVICES Final Report, Jun. - Dec. 1975
Richard W. Radlinski Aug. 1976 307 p refs
(PB-258443/1; DOT-HS-801-967) Avail: NTIS HC A14/MF A01 CSCL 13F

Tests were run in accordance with procedures specified in the standard and also in accordance with other test procedures that were developed during the course of the program to simulate typical on-highway emergency situations. The use of three different stability augmentation devices on tractor-trailer combinations was also evaluated to determine if these devices affected vehicle braking performance. GRA

N77-17492# Ultrasystems, Inc., Phoenix, Ariz. Dynamic Science Div.
DEVELOPMENT AND DEMONSTRATION OF SCHOOL BUS VERTICAL ROOF LOADING TEST PROCEDURE Final Report, Mar. - May 1976
E. Enserink Sep. 1976 40 p refs
(Contract DOT-HS-6-01316)
(PB-258336/7; DOT-HS-802-012; Rept-3968-76-33) Avail: NTIS HC A03/MF A01 CSCL 13F

The load was applied by means of two hydraulic cylinders acting on a rigid loading plate measuring 36 inches wide by 321 inches long located on the bus roof. Loading plate displacement was measured at two locations and bus roof displacement at three locations. Results indicate that the procedure specified is practical and appears to be workable for all school buses currently being marketed. GRA

N77-17493# AiResearch Mfg. Co., Torrance, Calif.
DESIGN STUDIES AND DESIGN OF COMPACT LIGHTWEIGHT, UNCURED SOLID PROPELLANT ENGINE-GEAR SUBSYSTEM Interim Report, 1 Jul. 1975 - 30 May 1976
Dietrich Roesler, R. L. Schultz, J. C. Riple, R. F. Keating, F. T. Yokota, R. A. Jones, W. J. Lawrence, J. Trowbridge, and T. C. Warren 15 Jul. 1976 108 p Prepared in cooperation with United Technologies Corp., Sunnyvale, Calif.
(Contract DAAG53-75-C-0268)
(AD-A030138; AiResearch-76-12931) Avail: NTIS HC A06/MF A01 CSCL 10/2

Design concepts and design of a compact, lightweight engine gear subsystem using uncured propellant were investigated. Various propellant formulations were prepared and tested for ballistic, rheological, and safety characteristics. A subscale gas generator was investigated experimentally. Author (GRA)

N77-17494# AiResearch Mfg. Co., Phoenix, Ariz.
DEVELOPMENT OF A FLUIDIC CONTROL SYSTEM FOR A GAS TURBINE GENERATOR SET Contractor's Report, 15 Nov. 1974 - 30 Apr. 1976
Michael J. Hoglund Adelphi, Md. HDL Sep. 1976 69 p
(Contract DAAG39-75-C-0076; DA Proj. 1T1-62114-AH-73; HDL Proj. 304634)
(AD-A028774; AiResearch-76-411372; HDL-CR-76-076-1) Avail: NTIS HC A04/MF A01 CSCL 10/2

This report presents the results of a program conducted to evaluate the application of fluidics to an automatic start sequence and protective control system of an auxiliary power gas turbine engine. The program encompassed the engine selection, control design, and test of the fluidic controller known as an Engine Logic Pack. The program successfully demonstrated by engine test that fully automatic control of a gas turbine engine with fluidics is feasible and that the protective functions required for safety may be incorporated into this control by means of fluidic technology. Author (GRA)

N77-17311# Osaka Univ. (Japan). Dept. of Precision Engineering.
ELASTIC EMISSION MACHINING
Yuzo Mori, Naoya Ikawa, and Kazuhisa Sugiyama *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 557-566 refs (For primary document see N77-17291 08-31)
(Rept-1329) Avail: NTIS HC A10/MF A01

N77-17312# Osaka Univ. (Japan). Dept. of Mechanical Engineering for Industrial Machinery.
A DESIGN OF SCHEDULING SIMULATOR OF MULTI-STAGE PRODUCTION SYSTEM

Katsundo Hitomi, Nobuto Nakamura, Takayoshi Tamura (Nagoya Inst. of Technology), and Hiroki Azukizawa (Kobe Steel Industry Co., Ltd.) *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 567-574 refs (For primary document see N77-17291 08-31)
(Rept-1330) Avail: NTIS HC A10/MF A01

N77-17313# Osaka Univ. (Japan). Dept. of Mechanical Engineering.
AIR JET DRIVEN OPEN-END SPINNING
Osamu Yaida and Akira Horikawa *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 575-582 refs (For primary document see N77-17291 08-31)
(Rept-1331) Avail: NTIS HC A10/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-17495* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR MEASURING WEB MATERIAL WOUND ON A REEL Patent
Ronald M. Muller, inventor (to NASA) Issued 4 Jan. 1977 9 p Filed 4 Apr. 1975 Supersedes N75-22687 (13 - 14, p 1652)
(NASA-Case-GSC-11902-1; US-Patent-4,001,552; US-Patent-Appl-SN-565289; US-Patent-Class-235-92DN; US-Patent-Class-235-92CA; US-Patent-Class-235-92CT; US-Patent-Class-235-92R) Avail: US Patent Office CSCL 14B

The method and apparatus for measuring the number of layers of a web material of known thickness wound on a storage or take-up reel is presented. The method and apparatus are based on the principle that, at a relatively large radius, the loci of layers of a thin web wound on the reel approximate a family of concentric circles having radii respectively successively increasing by a length equal to the web thickness. Tachometer pulses are generated in response to linear movement of the web and reset pulses are generated in response to rotation of the reel. A digital circuit, responsive to the tachometer and reset pulses, generates data indicative of the layer number of any layer of the web and of position of the web within the layer without requiring numerical interpolation.
Official Gazette of the U.S. Patent Office

N77-17496*# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
PROCEDURES FOR THE CALIBRATION OF ASTM E127-TYPE ULTRASONIC REFERENCE BLOCKS
D. J. Chwirut, G. F. Sushinsky, and D. G. Eitzen Sep. 1976 46 p refs Sponsored in part by NASA, Washington, D. C.; and Army Materials and Mechanics Research Center, Watertown, Mass.
(Contract F33615-74-M-6752)
(NASA-CR-149617; PB-258105/6; NBS-TN-924) Avail: NTIS HC A03/MF A01 CSCL 14B

A single well-characterized reference block, carefully chosen to be as close as possible to typical or nominal has been designated as an interim standard against which other blocks can be compared. As refinements are made and the system becomes better understood, new standards may be developed leading to the development of an absolute national standard. The facilities and procedures used in this calibration service are described herein. GRA

N77-17497# Oak Ridge Y-12 Plant, Tenn.
QUALITY ASSURANCE AT AN ERDA INSTALLATION
H. E. Alvey 16 Apr. 1976 17 p Presented at the 5th Seminar on Practical Appl. in Mfg., Gatlinburg, Tenn., 23 Apr. 1967
(Contract W-7405-eng-26)
(Y-NA-359; Conf-760468-8) Avail: NTIS HC A02/MF A01

Quality assurance in machining operations at the Oak Ridge Y-12 plant is described. Examples of different levels of quality assurance used in the machining of various hardware items used in the space program are given. ERA

N77-17498# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF QUALITY ASSURANCE GUIDELINES TO THE HIGH PRESSURE GAS SYSTEM, BUILDING 331
S. Hanel 10 Mar. 1976 16 p refs
(Contract W-7405-eng-48)
(UCID-17057) Avail: NTIS HC A02/MF A01

Major improvements were made to decrease the tritium release potential for tritium-handling facilities. Some of the major problems and solutions in designing and building the high pressure gas system, which was the first system to be rebuilt were described. To increase system safety, it was necessary to specify material and processes used in component manufacture, to inspect all materials and processes to ensure compliance with specifications, to use proper joint design, to use secondary containment in cases where specifications could not be met, and to exercise tighter control of operating procedures. ERA

N77-17499# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
GENERAL PROVISIONS FOR THE PRODUCT ASSURANCE OF ESA SPACECRAFT
Paris ESA 1 Oct. 1976 78 p Supersedes QRA-01-Issue-2 (ESA-PSS-01-ESTEC-Issue-1; QRA-01-Issue-2) Avail: NTIS HC A05/MF A01

Requirements are established for an integrated contractor product assurance system. These requirements pertain to the safety, reliability, quality and maintainability of systems and equipment as well as to the qualification of parts, materials and manufacturing processes and to the procedures for configuration control of design, fabrication testing, delivery and launch support of spacecraft equipment built under contract to ESA. Information is also provided that will enable a contractor to establish and maintain a basic product assurance system acceptable to ESA and in agreement with all requirements of the contract/purchase order. Author (ESA)

N77-17500# Army Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF AUTOMATED EVALUATION OF FIELD WELD RADIOGRAPHS Final Report
F. Kearney and J. Fornango Jul. 1976 21 p refs
(DA Proj. 4A7-62719-AT-41)
(AD-A028605; CERL-TR-M-185) Avail: NTIS HC A02/MF A01 CSCL 14/5

Since evaluation of field welds using radiographs requires that an inspector compare the radiograph with a standard, subjectivity is introduced. An automated image-analyzing system is proposed to remove this subjectivity. Radiographs containing sharp, well-defined defects on a uniform background can be analyzed the cathode-ray scanners and special-purpose computers in real time. However, the visual contrast in field weld radiographs is rather poor, and many extraneous features are usually present. A scan of 80 standard radiographs using an image analyzer detected only 296 weld defects while human operators identified 988. Techniques for enhancement and filtering of extraneous features are essential to the automated analysis of field weld radiographs. It is recommended that further work on development of an automatic radiographic analyzer be deferred until major advancements occur in the state of the art of image analysis.
Author (GRA)

N77-17501# Rockwell International Science Center, Thousand Oaks, Calif. Science Center.
WEIBULL TOLERANCE INTERVALS ASSOCIATED WITH SMALL SURVIVAL PROPORTIONS FOR USE IN A NEW FORMULATION LANCHESTER COMBAT THEORY
Nancy R. Mann 10 May 1976 17 p refs
(Contract N00014-73-C-0474; NR Proj. 042-321)
(AD-A028328) Avail: NTIS HC A02/MF A01 CSCL 14/4

Given herein is an easily implemented method for obtaining from complete or censored data, approximate tolerance intervals associated with the upper tail of a Weibull distribution. These approximate intervals are based on point estimators that make

essentially most efficient use of sample data. They agree extremely well with exact intervals (obtained by Monte Carlo simulation procedures) for sample sizes of about 10 or larger when specified survival proportions are sufficiently small. Ranges over which the error in the approximation is within 2 percent are determined. The motivation for investigation of the methodology for obtaining the approximate tolerance intervals was provided by the new formulation of Lanchester Combat Theory by Grubbs and Shuford, which suggests a Weibull assumption for time-to-incapacitation of key targets. With the procedures investigated herein, one can use (censored) data from battle simulations to obtain confidence intervals on battle times associated with given low survivor proportions of key targets belonging to either specified side in a future battle. It is also possible to calculate confidence intervals on a survival proportion of key targets corresponding to a given battle duration time. GRA

N77-17295# Osaka Univ. (Japan). Dept. of Applied Physics.
RELIABILITY ANALYSIS OF A PARALLEL REDUNDANT SYSTEM WITH TWO DISSIMILAR CORRELATED UNITS
Takshi Itoi, Tatsuo Murakami, Masanori Kodama, and Toshio Nishida *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 403-410 refs (For primary document see N77-17291 08-31)
(Rept-1312) Avail: NTIS HC A10/MF A01

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-17502 Northwestern Univ., Evanston, Ill.
TRANSIENT STRESS MEASUREMENTS ON POLYSTYRENE SOLUTIONS Ph.D. Thesis
Richard Lee Crawley 1976 213 p
Avail: Univ. Microfilms Order No. 76-1237

Using three polystyrene solutions (zero shear viscosities of 900, 3,900, and 56,000 poise) stress transient data were taken at the sudden initiation and cessation of simple shear cone and plate flow. Studies were made on the effect of gap angle, platen diameter, axial and torsional stiffness. The stress transient data were used to test the Van Es and Christensen criterion. The calculated VC(t) values failed to meet the criteria necessary for integral constitutive equations with memory functions dependent on the rate-of-deformation, tensor. Bernstein Kearsley Zapas (BKZ) rheological relations were used to predict stress transient curves from the experimental data. These predictions did not in general agree with the experimental stress transient data. The BKZ Elastic Fluid appears not to be a suitable model for the polystyrene solutions used in this study. Dissert. Abstr.

N77-17503*# Lehigh Univ., Bethlehem, Pa.
THE PROBLEM OF INTERNAL AND EDGE CRACKS IN AN ORTHOTROPIC STRIP
F. Delale and F. Erdogan Jul. 1976 25 p refs
(Grants NGR-39-007-011; NSF ENG-73-045053-A01)
(NASA-CR-149527) Avail: NTIS HC A02/MF A01 CSCL 13M

The plane elastostatic problem of internal and edge cracks in an infinite orthotropic strip is considered. The problems for the material types 1 and 2 are formulated in terms of singular integral equations. For the symmetric case the stress intensity factors are calculated and are compared with the isotropic results. The results show that because of the dependence of the Fredholm kernels on the elastic constants, unlike the crack problem for an infinite plane, in the strip the stress intensity factors are dependent on the elastic constants and are generally different than the corresponding isotropic results. Author

N77-17504*# Del West Associates, Inc., Woodland Hills, Calif.
MSFC CRACK GROWTH ANALYSIS COMPUTER PROGRAM, VERSION 2 (USERS MANUAL)
Matthew Creager Aug. 1976 184 p refs
(Contract NAS8-31624)
(NASA-CR-150153) Avail: NTIS HC A09/MF A01 CSCL 13M

An updated version of the George C. Marshall Space Flight Center Crack Growth Analysis Program is described. The updated computer program has significantly expanded capabilities over the original one. This increased capability includes an extensive expansion of the library of stress intensity factors, plotting capability, increased design iteration capability, and the capability of performing proof test logic analysis. The technical approaches used within the computer program are presented, and the input and output formats and options are described. Details of the stress intensity equations, example data, and example problems are presented. Author

N77-17505# Technische Hogeschool, Delft (Netherlands).
A GENERAL THEORY FOR THE INTERACTION BETWEEN LOCAL AND OVERALL BUCKLING OF STIFFENED PANELS
W. T. Kotter and M. Pignataro Apr. 1976 51 p refs
(WTHD-83; FR-556) Avail: NTIS HC A04/MF A01

The concept of slowly varying functions was employed in the derivation of a relatively simple approximate energy expression which governed combined local and overall buckling of the panel. In addition to the ratio of the critical stresses for overall and local buckling, the energy expression depended essentially on only one further nondimensional parameter. Moreover, the latter parameter depended only on properties of the cross-section, and it did not vary widely for well-designed panels likely to be encountered in practice. The stiffened panel is still extremely sensitive to very small imperfection, but it is established that this imperfection sensitivity is very much reduced for imperfection magnitudes likely to occur in practice. The maximum reduction in critical stress due to mode interaction and the presence of imperfections need not exceed about 10 percent in well-designed panels. Author

N77-17506*# Lehigh Univ., Bethlehem, Pa.
A NOTE ON THE BENDING OF A CRACKED STRIP
R. Erdol and F. Erdogan Jul. 1976 14 p refs
(Grants NGR-39-007-011; NSF ENG-73-045053-A01)
(NASA-CR-149584) Avail: NTIS HC A02/MF A01 CSCL 13M

A technique is described for calculating the stress intensity factors in a strip under bending by treating the strip as a two-dimensional continuum rather than a simple beam in evaluating the crack surface tractions used for the solution of the perturbation problem. Author

N77-17507*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
INFLUENCE OF TRANSVERSE SHEAR ON AN AXIAL CRACK IN A CYLINDRICAL SHELL
Steen Krenk (Research Establishment Risoe, Roskilde, Denmark) Jul. 1976 42 p refs
(Grants NGR-30-007-011; NSF ENG-73-045053-A01)
(NASA-CR-149528) Avail: NTIS HC A03/MF A01 CSCL 13M

An axial crack in a cylindrical shell is investigated by use of a 10th order shell theory, which accounts for transverse shear deformations as well as a special kind of orthotropy. The symmetric problem is formulated in terms of two coupled singular integral equations, which are solved numerically. The asymptotic membrane and bending stress fields ahead of the crack are found to be self similar. Stress intensity factors are given as a function of the shell parameter for various values of the ratio crack length to shell thickness. considerable differences from 8th order shell theory results are found for the bending stresses, while the membrane stresses of the 8th order theory seem to be a lower limit reached for very thin shells. Author

N77-17508# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
THE STATE OF THE ART IN THE FATIGUE LIFE EVALUATION OF COMPONENTS
Dieter Schuetz 1976 9 p refs Repr. from Fortdruck aus VDI-Berichte (West Germany), no. 268, 1976 p 171-178 In GERMAN; ENGLISH summary

Avail: NTIS HC A02/MF A01

The parameters of the chosen design data which do not fit the evaluated component were in most cases taken into consideration by very global factors. These factors and the inaccuracies of Miner's Rule provide only a rough estimate of the fatigue life of a component. When the component is available, uncertainties are reduced by performing a fatigue test with service like load-time histories and a revative Miner's Calculation. Author

N77-17509*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va. Dept. of Materials Engineering.

CREEP-RUPTURE DATA ANALYSIS - ENGINEERING APPLICATION OF REGRESSION TECHNIQUES Ph.D. Thesis - North Carolina State Univ.

Donald R. Rummler 1976 166 p refs

(NASA-TM-X-74330) Avail: NTIS HC A08/MF A01 CSCL 13M

The results are presented of investigations to apply regression techniques to the development of methodology for creep-rupture data analysis. Regression analysis techniques are applied to the explicit description of the creep behavior of materials for space shuttle thermal protection systems. A regression analysis technique is compared with five parametric methods for analyzing three simulated and twenty real data sets, and a computer program for the evaluation of creep-rupture data is presented. Author

N77-17510# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE INVESTIGATION OF STRAINS AND STRESSES BY THE METHOD OF PHOTOELASTIC COATINGS (SURVEY)

A. Ya. Aleksandrov and M. Kh. Akhmetzyanov [1976] 18 p refs Transl. into ENGLISH from Zavod. Lab. (USSR), v. 42, no. 11, Nov. 1976 p 1386-1395

Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Strain distributions in microdomains of metal grain type structures were investigated by the photoelastic coatings method. It is found that the coating thickness governs the minimally discriminable details of the optical patterns. The process of residual strain accumulation in microdomains with multi-cyclical loadings can be observed by means of the band patterns in the coatings. The method permits an effective study of linear elastic problems, and a broad range of nonlinear problems of elasticity, plasticity and creep strains, as well. I.M.

N77-17511# Lockheed Missiles and Space Co., Palo Alto, Calif.

ENERGETIC CHARACTERISTIC OF NECESSARY OPTIMALITY CONDITIONS

V. B. Grinev and A. P. Filippov [1976] 3 p refs Transl. into ENGLISH from the book "Optimizatsiya Elementov Konstruktsii po Mekhanicheskim Kharakteristikam" Kiev, Naukova Dumka Press, 1975 p 50-54

Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Starting with a notation for the potential and kinetic energies of a strained rod, the differential equation of free longitudinal vibrations is obtained for the stationary condition of the Ostrogradskii-Hamilton function. The equations for the configuration for natural frequencies, and the equations for the amplitude value of the potential and kinetic energies per unit of the rod are derived. F.O.S.

N77-17512*# Texas Univ., Austin.

SUBSTRUCTURE COUPLING FOR DYNAMIC ANALYSIS AND TESTING Final Report

Roy R. Craig, Jr. and Ching-Jone Chang Washington NASA Feb. 1977 91 p refs

(Grant NsG-1001)

(NASA-CR-2781) Avail: NTIS HC A05/MF A01 CSCL 13M

Fixed interface and free interface methods of substructure coupling for dynamic analysis are discussed. Three methods for reducing the number of coordinates required by fixed interface methods are introduced. Matrix ordinary differential equations are employed to improve accuracy in free interface substructure coupling methods. Author

N77-17513# Lockheed Missiles and Space Co., Palo Alto, Calif.

SOME INFORMATION ON OPTIMIZATION PROBLEMS

V. B. Grinev and A. P. Filippov [1976] 20 p refs Transl. into ENGLISH from Naukova Dumka (Kiev), 1975 p 5-32

Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Optimization problems for the simplest one-dimensional structure elements, rods, beams, circular plates, and turbine discs - together with their mechanical characteristics - were investigated. That set of geometric parameters is established to which the mechanical characteristics communicate a minimal value and to which a definite quality functional corresponds. The optimization problems under consideration can be formulated as corresponding problems of the calculus of variations. I.M.

N77-17514# Brookhaven National Lab., Upton, N.Y.

APPLICATIONS OF SAP TO STRUCTURAL DESIGN USING PRE AND POST PROCESSORS

Carl L. Goodzeit 1976 14 p refs Presented at 1st SAP User's Conf., Los Angeles, 7-11 Jun. 1976 Sponsored by ERDA

(BNL-21305) Avail: NTIS HC A02/MF A01

The finite element method was used for structural design of equipment in nuclear and physics research programs. Much of the effort of data preparation of SAP4 was eliminated through the use of computer generated output data for two- and three-dimensional structural problems. Computer graphics were found to be useful in checking the input data grid structure of the model being analyzed, and also for evaluating the structural response with deformed structure plots. These procedures are described, and their use is illustrated with examples of two- and three-dimensional structural analysis. ERA

N77-17515# Oak Ridge Gaseous Diffusion Plant, Tenn.

CALCULATION OF THE STRESS INTENSITY FACTORS IN THICK CYLINDERS SUBJECTED TO TRANSIENT TEMPERATURE GRADIENTS BY THE FINITE ELEMENT METHOD

S. K. Iskander Apr. 1976 35 p refs

(Contract W-7405-eng-26)

(K/CSD/TM-2) Avail: NTIS HC A03/MF A01

Procedures developed to calculate the opening mode stress intensity factor K/sub I/ for cracks of various depths in a thick cylinder subject to a transient temperature gradient are described. The method used is based upon the Griffith-Irwin-Orowan strain energy release rate concept. The strain energy was calculated with a two-dimensional finite element program based on constaint strain triangles. A comparison between results obtained by this method and the closed form results obtained by Isida for a center crack in a plate is made in an attempt to assess the accuracy of the method. ERA

N77-17516# Oak Ridge National Lab., Tenn. Reactor Div.

ASSESSMENT OF THE VALIDITY OF INELASTIC DESIGN ANALYSIS METHODS BY COMPARISONS OF PREDICTIONS WITH TEST RESULTS

J. M. Corum, J. A. Clinard, and W. K. Sartory 1976 33 p refs Presented at IAEA Intern. Working Group on Fast Reactors, Champion, Pa., 27 Apr. 1976 Sponsored by ERDA

(CONF-760451-1) Avail: NTIS HC A03/MF A01

A description is given of some of the work under way in the United States to provide the necessary information to evaluate inelastic analysis methods and computer programs used in fast reactor component design, and typical comparisons of analysis predictions with inelastic structural test results are presented. It is believed that the analysis predictions are generally valid, even though exact correlations between predictions and actual behavior are not obtained and cannot be expected. ERA

N77-17517# California Univ., Livermore. Lawrence Livermore Lab.

INTERNAL VARIABLE THEORY OF PLASTICITY BASED ON DISLOCATION MECHANICS Ph.D. Thesis

Roger Wayne Werne Apr. 1976 157 p refs

(Contract W-7405-eng-48)

(UCRL-52062) Avail: NTIS HC A08/MF A01

By decomposing the deformation gradient into its elastic and plastic components, the dislocation density tensor is expressed in terms of the plastic deformation gradient. Similarly, the rate

of plastic deformation tensor is expressed as a function of the mobile dislocation density tensor and the dislocation velocity vector. For isotropic materials, a representation theorem is used to express the dislocation velocity vector in terms of the dislocation density and the macroscopic state of stress. It is shown that under the condition of plastic incompressibility, the octahedral shear planes of the stress tensor are the glide planes for dislocation motion. Thus the total rate of plastic deformation is obtained by summing the dislocation motion over the eight octahedral shear planes of the stress tensor. ERA

N77-17518# Southampton Univ. (England). Inst. of Sound and Vibration Research.

IDENTIFICATION OF VIBRATING SYSTEMS BY GENERIC MODELLING, WITH AN APPLICATION TO FLUTTER

P. J. Holmes and D. A. Rand Nov. 1975 143 p refs Sponsored by Sci. Res. Council and Social Sci. Res. Council

(ISVR-TR-79) Avail: NTIS HC A07/MF A01

The aim of this paper is to indicate how recent mathematical work on qualitative dynamics makes possible an accessible but rigorous synthesis of the intuitive, theoretical, and empirical aspects of certain engineering problems. This leads to a new, and usable approach to the problem of the identification of complex dynamical systems such as those of vibration engineering. An application of the approach to aeroelastic flutter is included together with an outlined synthesis of the intuitive, lumped element, continuum mechanical and experimental aspects of this problem. The onset of flutter and divergence correspond to a bifurcation in the governing dynamical system. In the presence of such bifurcations, and under reasonable hypotheses, center manifold theory can be used to reduce the complexity of the problem. For example, it allows to replace the original dynamical system which may have high or infinite dimensional manifold for state space by an ordinary differential equation on a low dimensional state space, without losing any essential information. This leads us to the notion of an essential model. The general approach is summarized in figure 8. Author (ESA)

N77-17519# European Space Research and Technology Center, Noordwijk (Netherlands).

DESCRIPTION OF THE FINITE-ELEMENT MODEL FOR THE STATIC ANALYSIS OF THE RCA ITOS STRUCTURE

A. F. L. Soons Paris ESA Sep. 1976 54 p

(ESA-TN-130-ESTEC) Avail: NTIS HC A04/MF A01

The modelling of the RCA ITOS structure for the purpose of a finite-element static analysis, including the assumptions and approximations made is described. The analysis was performed on the computer with the aid of the ASKA program. The formats of the tapes on which both input and output data are stored are also described. The results of the calculations of the element cross-section properties are presented. Author (ESA)

N77-17520# California Univ., Berkeley. Earthquake Engineering Research Center.

INVESTIGATION OF THE INELASTIC CHARACTERISTICS OF A SINGLE STORY STEEL STRUCTURE USING SYSTEM IDENTIFICATION AND SHAKING TABLE EXPERIMENTS

Vernon C. Matzen and Hugh D. McNiven Aug. 1976 147 p refs

(Grants NSF AEN-73-07732; NSF ENV-76-04262)

(PB-258453/0; EERC-76-20) Avail: NTIS HC A07/MF A01 CSCL 13B

System identification is used to formulate a realistic nonlinear mathematical model to represent the seismic behavior of a single story steel structure. With this model and the parameters established for it, the energy absorbing characteristics of the structure are investigated. During this study, system identification itself is examined to determine how it can be better utilized in structural engineering. There are three major parts to this research. The first is the mathematical development of system identification to meet the particular needs of this problem. The second part of the research involved shaking table experiments in which a single story steel frame was subjected to several earthquake excitations. The tests were designed to give specific information about the structure: how its behavior depends on the particular excitation, and how the previous loading history affects its subsequent behavior. The last part of the research is the use of test data in the identification program to establish the four parameters in the mathematical model. GRA

N77-17521# Control Data Corp., Rockville, Md. Professional Services Div.

PREDICTING THE LIMITING PERFORMANCE OF AUTOMOBILE STRUCTURAL COMPONENTS UNDER CRASH CONDITIONS Final Report, Dec. 1974 - Dec. 1975

S. Chander and W. D. Pilkey Sep. 1976 131 p refs

(Contract DOT-HS-6-01335)

(PB-257443/2; DOT-HS-802-007) Avail: NTIS HC A07/MF A01 CSCL 13F

An investigation for determining the optimum performance characteristics of automobiles under collision circumstances is reported. A technique called limiting performance was used. The first goal was to establish the feasibility of applying the limiting performance technique to the crash simulation of automobiles. Subsequent work demonstrated the utility of the new technique for the design of automobiles for crash passenger protection. Detailed results of the study are discussed. The computer programs REFORM and NLPERFORM are included. GRA

N77-17522# McCue, Boone, Tomsick, San Francisco, Calif.

THE INTERACTION OF BUILDING COMPONENTS DURING EARTHQUAKES Final Report

Gerald M. McCue and Garrison Kost (Engineering Decision Analysis Co., Inc., Palo Alto, Calif.) Jan. 1976 208 p refs

(Grant NSF ERT-74-23153)

(PB-258326/8; NSF/RA-7423153-MBT) Avail: NTIS HC A10/MF A01 CSCL 13M

Under certain conditions, buildings must endure dynamic as well as static forces. For seismic action, a model of four elements provides a frame of reference for considering the dynamic role of building components: the ground, the integrated structure, interdependent elements, and dependent elements. The components of the enclosure, finish, and service systems which are not part of the integrated structure must be considered as either dependent elements or interdependent elements, in accordance with their degree of dynamic interaction with the integrated structure. Significantly different design criteria pertain, depending upon which of these dynamic roles they perform. GRA

N77-17523# Southwest Research Inst., San Antonio, Tex.

DEVELOPMENT OF SYSTEM FOR MONITORING IN-SERVICE STRAINS IN POWER PLANT PIPING Final Report

E. B. Norris and L. M. Yeakley Jan. 1976 77 p

(EPRI Proj. 218-1)

(PB-257752/6; EPRI-NP-186) Avail: NTIS HC A05/MF A01 CSCL 13K

A biaxial, long-life, high-temperature strain transducer was developed. The transducer used a variable shield capacitance principle, and in laboratory tests had a resolution of 20 ue (0.01% full range) and a drift rate of 6 ue/hour (0.003% full range) at 1100 F. Its resolution and drift compared favorably with the best characteristics of commercially available uniaxial strain transducers. Also, the differential capacitance design provided for in-service calibration of the transducer. Future development of the strain monitoring system will include field evaluations in operating fossil and nuclear power plants. GRA

N77-17524# Swedish Council for Building Research, Stockholm.

DIAPHRAGM ACTION OF ASSEMBLED C-SHAPED PANELS

Goran Nyberg May 1976 144 p refs

(PB-257904/3; D9:1976; ISBN-91-540-2577-X) Avail: NTIS HC A07/MF A01 CSCL 13M

The most important question was to find out, if it is possible to subject such a plate to a load, which creates shear stresses in excess of the stress, which according to the theory of elasticity gives rise to a shear buckling phenomenon in the webs of the panels. After the appearance of shear buckling in the panels, a continued increase of the load is taken up by the use of a postbuckling range, i.e. a so called tensile field is created. The investigation included experiments on test plates as well as the development of a model for calculations. GRA

N77-17525# Drexel Univ., Philadelphia, Pa.
COMPARISON OF SOLUTION METHODS FOR COMPOSITE MATERIAL BEAM RESPONSE DUE TO IMPACT Final Report, Jul. 1974 - Jun. 1975
Pei Chi Chou and William J. Flis Dec. 1975 59 p refs
(Contract N62269-74-C-0639)
(AD-A028317; NADC-76093-30) Avail: NTIS HC A04/MF 01 CSCL 01/3

Several solution methods are compared as to their usefulness in treating impact problems. The problem used as a basis for comparison involves a simply supported beam impacted at mid-span by a mass. The early-time and late-time structural responses of the system have been computed by (1) an analytical solution, (2) the NASTRAN finite-element, structural-analysis computer program, using both the direct integration method and the modal analysis method, and (3) the method of characteristics. The results have been compared. The chief conclusions are that the method of characteristics is the most accurate method for early-time, and that the NASTRAN modal method is best suited for late-time structural response. GRA

N77-17526# Chicago Univ., Ill. Dept. of Geophysical Sciences.
ON THE SOLUTION OF THE INVERSE PROBLEM WITH AMPLITUDE AND NATURAL FREQUENCY DATA, PART 1
Victor Barcilon Jun. 1976 25 p refs
(Contract N00014-76-C-0034; NR Proj. 041-476)
(AD-A028776) Avail: NTIS HC A02/MF A01 CSCL 08/11

A procedure is presented for finding the elastic properties of a vibrating body. The data needed to insure a unique solution are contained in the impulse response. Thus both amplitude and natural frequencies are required. The particular case of a beam is used to illustrate the procedure. Author (GRA)

N77-17527# Advisory Group for Aerospace Research and Development, Paris (France).
SUMMARY OF THE DISCUSSIONS ON STRUCTURAL DESIGN TECHNOLOGY
R. B. Baird (Headquarters US AF, Pentagon, Washington, D. C.) Dec. 1976 13 p refs
(AGARD-AR-99; ISBN-92-835-1235-x) Avail: NTIS HC A02/MF A01

Structural design and questions created by improved technology are presented. Composite structures, fracture and fatigue mechanics, aeroelasticity and loads, and optimum and computer aided design are discussed along with USAF safety design philosophies. M.C.F.

N77-17307# Osaka Univ. (Japan). Dept. of Mechanical Engineering.
PHOTOELASTIC INVESTIGATION ON THE THERMAL STRESSES CAUSED BY A TRAVELING HEAT SOURCE
Hiroshi Kitagawa, Mamoru Furukawa (Kobe Univ. of Mercantile Marine), Takuo Hayashi, and Minoru Hamada *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 517-526 refs (For primary document see N77-17291 08-31)
(Rept-1325) Avail: NTIS HC A10/MF A01

N77-17315# Osaka Univ. (Japan). Dept. of Civil Engineering.
NONLINEAR ANALYSIS OF REINFORCED CONCRETE SLABS BY FINITE ELEMENT METHOD
Yukio Maeda, Shigeyuki Matsui, and Ichio Kojima *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 595-604 refs (For primary document see N77-17291 08-31)
(Rept-1333) Avail: NTIS HC A10/MF A01

N77-17316# Osaka Univ. (Japan). Dept. of Civil Engineering.
ELASTO-PLASTIC ANALYSIS OF THIN-WALLED STRUCTURES BY FINITE STRIP METHOD
Yukio Maeda, Masa Hayashi, and Ken-ichi Arioka *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 605-616 refs (For primary document see N77-17291 08-31)
(Rept-1334) Avail: NTIS HC A10/MF A01

42 GEOSCIENCES (GENERAL)

N77-17528# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
MANAGEMENT OF EXPERIMENTAL RESERVES AND THEIR RELATION TO CONSERVATION RESERVES: THE RESERVE CLUSTER
W. Carter Johnson, Jerry S. Olson, and David E. Reichle 1976 21 p refs Presented at US-USSR Joint Symp. on Biosphere Reserves, Moscow, 4 May 1976
(CONF-760520-1) Avail: NTIS HC A02/MF A01

Permanence of experiment locations assures the continuity of records necessary for monitoring the continual changes in the biosphere. The experimental ecological reserve system will add continuity by providing a coherent set of areas for active research, bringing together the areas, interests, and expertise represented by diverse institutional staffs. ERA

N77-17529*# Stanford Univ., Calif. Inst. for Plasma Research.
SOLAR ACTIVITY, GEOMAGNETIC FIELD AND TERRESTRIAL WEATHER
J. W. Knight and P. A. Sturrock Jul. 1976 13 p refs
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-149660; AD-A028423; SU-IPR-667) Avail: NTIS HC A02/MF A01 CSCL 08/14

There is strong evidence for a casual connection between the interplanetary magnetic field and geomagnetic activity, and some evidence for a connection (possibly indirect) between the interplanetary magnetic field structure and atmospheric vorticity. The interplanetary magnetic field originates in the sun and exhibits long-lived sector structure with a fairly well defined synodic rotation period of approximately 27.1 days. It would therefore appear that an independent test of these associations could be obtained by means of spectral analysis. A comparison of least-squares spectra reveals a feature, with period of order 27.1 days, common to both the geomagnetic activity index and the vorticity area index, lending support to the hypothesis that the sun can affect day-by-day terrestrial weather. Author (GRA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N77-17530 Washington Univ., Seattle.
AN ANALYSIS OF ABSORPTION AND PENETRATION OF RADIANT ENERGY INTO SNOW Ph.D. Thesis
Charles Newton Hoffeditz 1976 196 p
Avail: Univ. Microfilms Order No. 77-588

The areas investigated were: (1) the radiant energy exchange at the snow surface for both long and short-wave radiation, and (2) penetration of visible and near infra-red portions of short wave radiation within snow. Data were collected at Snoqualmie Pass in the Cascade Mountains of Washington at an elevation of 3,700 feet. Total absorbed radiant energy by snow at noon on a spring day averaged 34.6 mw per sq cm. Of this, 22.4 mw per sq cm were solar radiation, and the remaining 12.2 mw per sq cm, long wave radiation. Absorption in the visible and near infra-red wave lengths was 5.2 mw per sq cm. Albedo in the spring was .68. Absorption of radiant energy in the summer was almost twice that in spring, 71.5 mw per sq cm. Of the total radiation absorbed, over 69 percent (49.5 mw per sq cm) was solar radiation and the remaining 22.0 mw per sq cm, long wave radiation. Visible and near infra-red wave lengths measured 25.5 mw per sq cm of the solar energy absorbed in the summer. Dissert. Abstr.

N77-17531 Washington Univ., Seattle.
A FOREST HYDROLOGY MODEL OF VEGETATION-STREAMFLOW RELATIONS Ph.D. Thesis

John Daniel Fox, Jr. 1976 298 p
Avail: Univ. Microfilms Order No. 77-571

The sensitivity analysis performed in this study demonstrated that a watershed model can be used to estimate forest manipulation effects on water yield. The Coweeta watershed-13 study indicated the need for further testing before the model designed for this study can be accepted for management use. Improved identification of error attributable to data uncertainties and error attributable to the model itself is needed.

Dissert. Abstr.

N77-17532* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MISSION TO EARTH: LANDSAT VIEWS THE WORLD
Nicholas M. Short, Paul D. Lowman, Jr., Stanley C. Freden, and William A. Finch, Jr. (San Diego State Univ., Calif.) 1976 926 p refs Original contains color illustrations
(NASA-SP-360) Avail: SOD HC $14.00 CSCL 05B

The LANDSAT program and system is described. The entire global land surface of Earth is visualized in 400 color plates at a scale and resolution that specify natural land cultural features in man's familiar environments. A glossary is included. A.H.

N77-17533*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN Quarterly Progress Report, Oct. - Dec. 1976
Takakazu Maruyasu, Hiroaki Ochiai, Yasuhiro Sugimori, Daitaro Shoji, Kaname Takeda, Kiyoshi Tsuchiya, Iwao Nakajima, Takamasa Nakano, Shigechika Hayashi, Seiji Horikawa, Principal Investigators et al 20 Jan. 1977 6 p refs Sponsored by NASA ERTS
(E77-10080; NASA-CR-149563) Avail: NTIS HC A02/MF A01 CSCL 08C

There are no author-identified significant results in this report.

N77-17534*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. INVESTIGATION OF VARIATIONS IN THE PROMINENT OCEANIC CURRENT, KUROSHIO
Takakazu Maruyasu and Daitaro Shoji, Principal Investigators Jan. 1977 5 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10081; NASA-CR-149564) Avail: NTIS HC A02/MF A01 CSCL 08C

The author has identified the following significant results. Conspicuous results of composed color images were realized in the ground patterns, such as the fine meander of the Tenryu River. No significant difference was found between single band color image and multiband composed color image in the sea area. It was found that MSS was more advantageous for land than for sea; only band 4 shows dominant features in the sea.

N77-17535*# Tokyo Univ. (Japan).
WATER ENVIRONMENT EVALUATION FOR INLAND SEA BY PRINCIPAL COMPONENT ANALYSIS Quarterly Report
Shunji Murai, Principal Investigator 20 Dec. 1976 2 p Sponsored by NASA ERTS
(E77-10082; NASA-CR-149565) Avail: NTIS HC A02/MF A01 CSCL 08C

There are no author-identified significant results in this report.

N77-17536*# West Virginia Dept. of Natural Resources, Charleston.
CONTRIBUTION OF ERTS-B TO NATURAL RESOURCE PROTECTION AND RECREATIONAL DEVELOPMENT IN WEST VIRGINIA Progress Report, 19 Sep. - 19 Dec. 1976
Ira S. Latimer, Jr., Principal Investigator 5 Jan. 1977 5 p Sponsored by NASA ERTS
(E77-10083; NASA-CR-149566; PR-5) Avail: NTIS HC A01/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N77-17537*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. CLASSIFICATION OF SHORELINES Quarterly Report
Takakazu Maruyasu and Daitaro Shoji, Principal Investigators Jan. 1977 11 p Sponsored by NASA ERTS
(E77-10084; NASA-CR-149567) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. The sand beach was separated from sea water in each of four bands, if the beach had a width of 100 m or more. Density ranges of the sea for CCT counts were determined as 0-3 for band 7, 0-16 for band 6, 0-25 for band 5, and 0-27 for band 4.

N77-17538*# Department of Surveys and Lands, Gaborone (Botswana).
AN AID TO THE DEVELOPMENT OF BOTSWANA'S RESOURCES Quarterly Progress Report
J. A. Raffle, Principal Investigator Oct. 1976 3 p Sponsored by NASA ERTS
(E77-10085; NASA-CR-149568; C.1/3-63; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-17539*# Department of Surveys and Lands, Gaborone (Botswana).
AN AID TO THE DEVELOPMENT OF BOTSWANA'S RESOURCES Quarterly Progress Report
J. A. Raffle, Principal Investigator Jul. 1976 3 p Sponsored by NASA ERTS
(E77-10086; NASA-CR-149569; C.1/3-62; QPR-2) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-17540*# Alaska Univ., College.
LANDSAT SURVEY OF NEAR-SHORE ICE CONDITIONS ALONG THE ARCTIC COAST OF ALASKA Quarterly Progress Report
William J. Stringer, Principal Investigator [1976] 278 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10087; NASA-CR-149570; QPR-6; QPR-7) Avail: NTIS HC A13/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N77-17541*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
RECONNAISSANCE MAPPING FROM AERIAL PHOTOGRAPHS
H. A. Weeden and N. B. Bolling, Principal Investigators Aug. 1975 21 p refs ERTS
(Contracts NAS5-23133; NAS9-13406)
(E77-10088; NASA-CR-149571; ORSER-SSEL-TR-17-75) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Engineering soil and geology maps were successfully made from Pennsylvania aerial photographs taken at scales from 1:4,800 to 1:60,000. The procedure involved a detailed study of a stereoscopic model while evaluating landform, drainage, erosion, color or gray tones, tone and texture patterns, vegetation, and cultural or land use patterns.

N77-17542*# Comision Nacional del Espacio Exterior, Mexico City (Mexico).
COMPREHENSIVE STUDY OF LEON-QUERETARO AREA
Hector Alonso Espinosa, Humberto Ramos Moreno, and Jorge H. Olivares Martell, Principal Investigators 17 Dec. 1976 34 p refs Sponsored by NASA ERTS
(E77-10089; NASA-CR-149572; Rept-1) Avail: NTIS HC A03/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N77-17543*# Science Applications, Inc., La Jolla, Calif.
DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE FROM LANDSAT DATA Progress Report, 1 Aug. 1976 - 31 Jan. 1977
M. Griggs, Principal Investigator 1 Feb. 1977 14 p ERTS
(Contract NAS5-20899)
(E77-10093; NASA-CR-149576; SAI-77-502-LJ; PR-7; PR-8) Avail: NTIS HC A02/MF A01 CSCL 04B

There are no author-identified significant results in this report.

N77-17544*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
CROP IDENTIFICATION AND AREA ESTIMATION OVER LARGE GEOGRAPHIC AREAS USING LANDSAT MSS DATA Final Report, 25 Mar. 1975 - 24 Sep. 1976
Marvin E. Bauer, Principal Investigator Jan. 1977 174 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20793)
(E77-10094; NASA-CR-149577; LARS-TR-012477) Avail: NTIS HC A08/MF A01 CSCL 02C

The author has identified the following significant results. LANDSAT MSS data was adequate to accurately identify wheat in Kansas; corn and soybean estimates in Indiana were less accurate. Computer-aided analysis techniques were effectively used to extract crop identification information from LANDSAT data. Systematic sampling of entire counties made possible by computer classification methods resulted in very precise area estimates at county, district, and state levels. Training statistics were successfully extended from one county to other counties having similar crops and soils if the training areas sampled the total variation of the area to be classified.

N77-17545*# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
EXTENSIVE INVENTORY OF FOREST RESOURCES BY MULTISTAGE SAMPLING Progress Report, 7 Sep. - 6 Dec. 1976
Robert C. Aldrich, Robert W. Dana, and Edwin H. Roberts, Principal Investigators 28 Dec. 1976 6 p ref ERTS
(NASA Order S-54053-A)
(E77-10095; NASA-CR-149578; PR-7) Avail: NTIS HC A02/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N77-17546*# Arkansas Univ., Fayetteville. Dept. of Geology.
LAND USE CHANGE DETECTION WITH LANDSAT-2 DATA FOR MONITORING AND PREDICTING REGIONAL WATER QUALITY DEGRADATION Final Report, 27 Jan. 1975 - 26 Jul. 1976
H. MacDonald, K. Steele, Principal Investigators, W. Waite, R. Rice, M. Shinn, T. Dillard, and C. Petersen Jan. 1977 222 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20810)
(E77-10098; NASA-CR-149581) Avail: NTIS HC A10/MF A01 CSCL 08H

The author has identified the following significant results. Comparison between LANDSAT 1 and 2 imagery of Arkansas provided evidence of significant land use changes during the 1972-75 time period. Analysis of Arkansas historical water quality information has shown conclusively that whereas point source pollution generally can be detected by use of water quality data collected by state and federal agencies, sampling methodologies for nonpoint source contamination attributable to surface runoff are totally inadequate. The expensive undertaking of monitoring all nonpoint sources for numerous watersheds can be lessened by implementing LANDSAT change detection analyses.

N77-17547*# Norwegian Water Resources and Electricity Board, Oslo.
HYDROLOGICAL INVESTIGATIONS IN NORWAY Quarterly Report, 1 May - 1 Dec. 1976
Helge A. Odegaard, Principal Investigator 1 Dec. 1976 3 p Sponsored by NASA ERTS
(E77-10099; NASA-CR-149582) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-17548*# Washington Univ., St. Louis, Mo. Center for Development Technology.
PROGRAM ON EARTH OBSERVATION DATA MANAGEMENT SYSTEMS (EODMS) Final Report, 1 Jun. - 31 Dec. 1976
Lester F. Eastwood, Jr., John Kenneth Gohagan, Christopher T. Hill, Robert P. Morgan, Timothy R. Hays, Richard J. Ballard, Gregory R. Crnkovick, and Mark A. Schaeffer 31 Dec. 1976 268 p refs
(Contract NAS5-20680)
(NASA-CR-144845) Avail: NTIS HC A12/MF A01 CSCL 05B

An assessment was made of the needs of a group of potential users of satellite remotely sensed data (state, regional, and local agencies) involved in natural resources management in five states, and alternative data management systems to satisfy these needs are outlined. Tasks described include: (1) a comprehensive data needs analysis of state and local users; (2) the design of remote sensing-derivable information products that serve priority state and local data needs; (3) a cost and performance analysis of alternative processing centers for producing these products; (4) an assessment of the impacts of policy, regulation and government structure on implementing large-scale use of remote sensing technology in this community of users; and (5) the elaboration of alternative institutional arrangements for operational Earth Observation Data Management Systems (EODMS). It is concluded that an operational EODMS will be of most use to state, regional, and local agencies if it provides a full range of information services -- from raw data acquisition to interpretation and dissemination of final information products. Author

N77-17549*# Texas A&M Univ., College Station. Remote Sensing Center.
REMOTE SENSING OF ST. AUGUSTINE DECLINE (SAD) DISEASE
William Claude Odle Aug. 1976 177 p refs
(Grant NGL-44-001-001)
(NASA-CR-149586; TR-RSC-77) Avail: NTIS HC A09/MF A01 CSCL 02C

Laboratory and field spectral reflectance measurements of healthy and infected St. Augustine grass were made using several different instruments. Spectral differences between healthy and infected grass occured in the visible and near infrared regions. Multiband and color infrared photographs were taken of healthy and diseased turf from ground-based platforms and low altitude aircraft. Qualitative (density slicing) and quantitative (transmission densitometry) analyses revealed distinct tonal differences between healthy and St. Augustine disease (SAD) infected grass. Similar experiments are described for determining if healthy and diseased grass can be distinguished from waterstressed grass and grass deficient in either nitrogen or iron. Author

N77-17550*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PROCEDURE USED FOR A GROUND TRUTH STUDY OF A LAND USE MAP OF NORTH ALABAMA GENERATED FROM LANDSAT DATA
Sanford W. Downs, Jr., G. C. Sharma, and Colin Bagwell Washington Feb. 1977 62 p refs
(NASA-TN-D-8420; M-209) Avail: NTIS HC A04/MF A01 CSCL 08B

A land use map of a five county area in North Alabama was generated from LANDSAT data using a supervised classification algorithm. There was good overall agreement between the land use designated and known conditions, but there were also obvious discrepancies. In ground checking the map, two types of errors were encountered - shift and misclassification - and a method was developed to eliminate or greatly reduce the errors. Randomly selected study areas containing 2,525 pixels were analyzed. Overall, 76.3 percent of the pixels were correctly classified. A contingency coefficient of correlation was calculated to be 0.7 which is significant at the alpha = 0.01 level. The

land use maps generated by computers from LANDSAT data are useful for overall land use by regional agencies. However, care must be used when making detailed analysis of small areas. The procedure used for conducting the ground truth study together with data from representative study areas is presented. Author

N77-17551*# Maryland Univ., College Park. Dept. of Civil Engineering.

A COMPARISON BETWEEN CONVENTIONAL AND LANDSAT BASED HYDROLOGIC MODELING: THE FOUR MILE RUN CASE STUDY Final Report, Jul. 1975 - Sep. 1976

Robert M. Ragan, Thomas J. Jackson, William N. Fitch (Water Resources Engineers, Inc., Springfield, Va.), and Robert P. Shubinski (Water Resources Engineers, Inc., Springfield, Va.) Oct. 1976 130 p refs

(Grant NsG-5017)

(NASA-CR-149450) Avail: NTIS HC A07/MF A01 CSCL 08H

Models designed to support the hydrologic studies associated with urban water resources planning require input parameters that are defined in terms of land cover. Estimating the land cover is a difficult and expensive task when drainage areas larger than a few sq. km are involved. Conventional and LANDSAT based methods for estimating the land cover based input parameters required by hydrologic planning models were compared in a case study of the 50.5 sq. km (19.5 sq. mi) Four Mile Run Watershed in Virginia. Results of the study indicate that the LANDSAT based approach is highly cost effective for planning model studies. The conventional approach to define inputs was based on 1:3600 aerial photos, required 110 man-days and a total cost of $14,000. The LANDSAT based approach required 6.9 man-days and cost $2,350. The conventional and LANDSAT based models gave similar results relative to discharges and estimated annual damages expected from no flood control, channelization, and detention storage alternatives. Author

N77-17552*# Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.

SOIL MOISTURE GROUND TRUTH, HAND COUNTY, SOUTH DAKOTA, OCTOBER 20, 1976

E. Bruce Jones Dec. 1976 35 p refs

(Contract NAS5-22312)

(NASA-CR-144841) Avail: NTIS HC A03/MF A01 CSCL 08M

Analyses of soil samples taken at three depths are presented in tables. Data include soil types, temperature, and moisture content. Author

N77-17553*# Arizona Univ., Tucson. Office of Arid Lands Studies.

APPLIED REMOTE SENSING PROGRAM (ARSP) Progress Report, 1 Sep. - 30 Nov. 1976

[1977] 26 p

(Grant NGL-03-002-313)

(NASA-CR-149588; PR-2) Avail: NTIS HC A03/MF A01 CSCL 08F

Imagery from U-2 flight or Skylab is used to produce maps of Arizona for resource management and land use. Color photography and thermal mapping techniques are described for studying vegetation growth, natural resources, flood plains, soil erosion, and heat loss from buildings. A.R.H.

N77-17554# Environmental Research Inst. of Michigan, Ann Arbor.

BASIC REMOTE SENSING INVESTIGATION FOR BEACH RECONNAISSANCE Interim Report, 1 Jun. - 31 Dec. 1975

F. Thompson, R. Shuchman, C. Wezernak, D. Lyzenga, and D. Leu Jul. 1976 127 p refs

(Contract N00014-74-C-0273)

(AD-A029041; ERIM-108900-5-P) Avail: NTIS HC A07/MF A01 CSCL 15/4

Progress is reported on three tasks designed to develop remote sensing beach reconnaissance techniques applicable to the benthic, beach intertidal, and beach upland zones. Task 1 is designed to develop remote sensing indicators of important beach composition and physical parameters which will ultimately prove useful in models to predict beach conditions. Task 2 is designed to develop remote sensing techniques for survey of bottom features in the benthic zone. Task 3 is designed to develop radar processing techniques to delineate important beach intertidal and upland parameters and to better understand the potential of radar-derived information when used with optical sensor data. Author (GRA)

N77-17555# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.

DEGASIFICATION AND PRODUCTION OF NATURAL GAS FROM AN AIRSHAFT IN THE PITTSBURGH COALBED Report of Investigations 1976

H. H. Fields, Joseph Cervik, T. W. Goodman, and D. C. Oyler Aug. 1976 30 p refs

(PB-258101/5; BM-RI-8173) Avail: NTIS HC A03/MF A01 CSCL 08I

The effectiveness of long holes drilled in solid virgin coal in degasifying an area of the Pittsburgh coalbed was studied. All holes were connected to the piping manifold, and maximum gas flow from the five degasification holes was measured at 994,000 cubic ft/d. After 691 days of degasification, a total of 611 million cubic feet of methane had been exhausted to the atmosphere. GRA

N77-17556# Bureau of Mines, Washington, D.C.

MINERALS IN THE US ECONOMY: TEN-YEAR SUPPLY-DEMAND PROFILES FOR MINERAL AND FUEL COMMODITIES (1965 - 1974)

Aug. 1976 105 p refs

(PB-258072/8; BM-SP-7-76) Avail: NTIS HC A06/MF A01 CSCL 08I

The Bureau of Mines prepared supply-demand flow diagrams and 10-year tables for mineral and fuel commodities that present essential data required by government, industry, and others to formulate policies and programs that can help assure an adequate and continuing supply of mineral raw materials. The 10-year data base terminates with 1974 figures because adequate world information was not available beyond that date. The selected mineral supply-demand tables and flow diagrams comprise but one 'output' from the massive body of information and data collected and compiled by the Bureau of Mines on a continuing basis covering mineral production, consumption, prices, shipments, imports, exports, and stocks, as well as industry activities in all states and abroad. GRA

N77-17557# Army War Coll., Carlisle Barracks, Pa.

PETROLEUM: A VITAL LINK IN NATIONAL SECURITY

Theodore G. Brna 13 Feb. 1976 35 p refs

(AD-A028919) Avail: NTIS HC A03/MF A01 CSCL 05/4

This study explores the effect of petroleum on the national security of the United States under possible peacetime and wartime environments of the next decade. A literature survey, using sources from computer searches, served as the research method. The national security of the United States is vitally dependent on petroleum, its major source of consumed energy, and this dependency is increasing as imports continue to rise. By 1980 Middle East sources will replace traditional Western Hemisphere sources as major suppliers of petroleum. Peacetime interruptions in oil imports can effect economic recessions as shown by a relationship between oil consumption and the Gross National Product. These interruptions would not preclude petroleum for military requirements. Under conventional war in Western Europe, the petroleum supplies for military requirements are adequate but diversion from civilian sectors may cause serious shortages. Petroleum from the United States to NATO countries for their requirements during wartime is uncertain, being related to the extent of the involvement and the success of compensatory measures affecting these environments. The United States requires a strong military capability to protect its oil import supply lines and a viable energy policy for achieving self-sufficiency in energy to enhance economic and national security. Author (GRA)

N77-17558# Army Engineer Topographic Labs., Fort Belvoir, Va.

THE POTENTIAL OF THERMAL INFRARED IMAGERY FOR SUPPLEMENTAL MAP INFORMATION IN SNOW-COVERED AREAS

Ambrose O. Poulin Jan. 1976 27 p refs
(AD-A028384; ETL-0059) Avail: NTIS HC A03/MF A01 CSCL 08/2

A map showing the snow-covered conditions of an area is needed because of the changes in appearance and physical condition of the terrain induced by freezing, partial freezing and the snow cover itself. These changes create problems regarding land navigation, mobility, evaluation of movement corridors and water supply that are significantly different from similar problems under snow-free conditions. The purpose of this report is to explain the rationale for the map, its format and its intended use and to provide background information for one unfamiliar with thermal infrared imagery and its use in cold regions. Color illustrations reproduced in black and white. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-17559* + National Aeronautics and Space Administration, Washington, D.C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 11
Oct. 1976 265 p refs
(NASA-SP-7043(11)) Avail: NTIS HC E05 CSCL 10B

This bibliography lists 602 reports, articles, and other documents introduced into the NASA scientific and technical information system from July 1, 1976 through September 30, 1976. Author

N77-17560*# Memphis State Univ., Tenn. Dept. of Mechanical Engineering.
OPTIMIZATION OF ABSORPTION AIR-CONDITIONING FOR SOLAR ENERGY APPLICATIONS Final Report, 1 Sep. 1974 - 31 Oct. 1976
Edward H. Perry Dec. 1976 68 p refs
(Contract NAS8-31189)
(NASA-CR-150176) Avail: NTIS HC A04/MF A01 CSCL 10A

Improved performance of solar cooling systems using the lithium bromide water absorption cycle is investigated. Included are computer simulations of a solar-cooled house, analyses and measurements of heat transfer rates in absorption system components, and design and fabrication of various system components. A survey of solar collector convection suppression methods is presented. Author

N77-17561# Mitre Corp., Bedford, Mass. Metrek Div.
SPURR: SYSTEM FOR PROJECTING UTILIZATION OF RENEWABLE RESOURCES
G. E. Bennington and Kathy K. Rebibo Oct. 1976 20 p refs
(M76-69) Avail: NTIS HC A02/MF A01

Special features are contained in the model to incorporate the commercialization of new energy technologies. These include price reductions based on accumulated experience, government demonstration programs, and options for various economic incentives. Regional analyses include regional variations in climate, demographic factors, and economic data. Author

N77-17562*# Kanner (Leo) Associates, Redwood City, Calif.
THE OPTIMUM CONFIGURATION OF ROTOR BLADES FOR HORIZONTAL WIND ENERGY CONVERTERS
W. Weber Washington NASA Feb. 1977 17 p refs Transl. into ENGLISH from Z. Flugwiss. (West Germany), v. 23, no. 12, 1975 p 443-447
(Contract NASw-2790)
(NASA-TT-F-17379) Avail: NTIS HC A02/MF A01 CSCL 10A

Considerations, procedures and some results relating to the problem of the aerodynamic configuration of rotor blades for wind energy converters are presented. Author

N77-17563*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INSPECTION OF TWO BRAYTON ROTATING UNITS AFTER EXTENSIVE ENDURANCE TESTING
James H. Dunn Dec. 1976 25 p refs
(NASA-TM-X-73569; E-9013) Avail: NTIS HC A02/MF A01 CSCL 10B

A system was designed to produce 2-10 kW net continuous electric power for at least 5 years. The turbine-alternator-compressor power conversion unit in the system is designated Brayton Rotating Unit (BRU). Four BRU's were fabricated and extensively tested. One BRU has accumulated 11,000 hours of operation, and another has accumulated in excess of 21,000 hours. Testing has demonstrated that the BRU's have met or exceeded performance objectives. Two BRU's were disassembled and given a thorough post-test inspection. The inspection results show that after 21,000 hours of operation there is no apparent wear or failure mode that will prevent the attainment of the 5-year life objective. Author

N77-17564*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR CELL COLLECTOR AND METHOD FOR PRODUCING SAME Patent Application
John C. Evans, Jr., inventor (to NASA) Filed 22 Feb. 1977 16 p
(NASA-Case-LEW-12552-1; US-Patent-Appl-SN-776869) Avail: NTIS HC A02/MF A01 CSCL 10A

A method is described which permits the formation of highly conductive metal channels in a continuous pattern of any desired design within a transparent conductive mixed oxide layer which covers and protects an underlying photovoltaic substrate. The result is a sufficient collector system for the current generated by incident photon radiation. NASA

N77-17565*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED BACKWALL CELL Patent Application
Henry W. Brandhorst, Jr., inventor (to NASA) Filed 19 Jan. 1977 15 p
(NASA-Case-LEW-12236-1; US-Patent-Appl-SN-760771) Avail: NTIS HC A02/MF A01 CSCL 10A

A solar cell is described having a first material of one conductivity type with one face having the same conductivity type more heavily doped to form a field region to receive the radiant energy. A layer of opposite conductivity type or a metallic layer forming a Schottky barrier is applied to the opposite face. A gridded contact pervious to the radiant energy may be applied to the region of the more heavily doped material for electrical contact. The device allows separate control of the junction, either the p-n junction or the Schottky diode junction, and the efficient collection of light. This efficiency is improved, because the high conductivity region has low sheet resistance, and a low surface recombination velocity with enhanced effective diffusion lengths in bulk. NASA

N77-17566*# Owens-Illinois, Inc., Toledo, Ohio.
THICK-FILM MATERIALS FOR SILICON PHOTOVOLTAIC CELL MANUFACTURE Final Report
M. B. Field Jan. 1977 22 p
(Contract NAS3-19441)
(NASA-CR-135134) Avail: NTIS HC A02/MF A01 CSCL 10A

Thick film technology is applicable to three areas of silicon solar cell fabrication; metallization, junction formation, and coating for protection of screened ohmic contacts, particularly wrap around contacts, interconnection and environmental protection. Both material and process parameters were investigated. Printed ohmic contacts on n- and p-type silicon are very sensitive to the processing parameters of firing time, temperature, and atmosphere. Wrap around contacts are easily achieved by first printing and firing a dielectric over the edge and subsequently applying a

low firing temperature conductor. Interconnection of cells into arrays can be achieved by printing and cofiring thick film metal pastes, soldering, or with heat curing conductive epoxies on low cost substrates. Printed (thick) film vitreous protection coatings do not yet offer sufficient optical uniformity and transparency for use on silicon. A sprayed, heat curable SiO2 based resin shows promise of providing both optical matching and environmental protection. Author

N77-17567# Ames Lab., Iowa.
ENVIRONMENTAL EFFECTS OF SOLID WASTE AS A SUPPLEMENTAL FUEL
J. L. Hall, A. W. Joensen, and H. R. Shanks Mar. 1976 34 p refs
(Contract W-7405-eng-82)
(IS-3852) Avail: NTIS HC A03/MF A01

Procurement and calibration of equipment as well as training of personnel was accomplished, and sampling is in progress to satisfy the objectives of the environmental study. All input and output stream associated with operation of the steam generating units are sampled. Sampling and characterization of fuel (both coal and processed refuse), ash and particulate effluent were accomplished. In addition, the oxides of nitrogen, oxides of sulfur and heavy organics were sampled. Author (ERA)

N77-17568# Sandia Labs., Albuquerque, N.Mex.
ELECTRICAL AND ENVIRONMENTAL TESTING OF LITHIUM V2O5 CELLS. 1: STORAGE AND DISCHARGE RATE STUDIES
Samuel C. Levy 1975 14 p refs Presented at the 27th Power Sources Symposium, Atlantic City, N.J., 21 Jun. 1976 Sponsored by ERDA
(SAND-75-5934; Conf-760617-1) Avail: NTIS HC A02/MF A01

The performance and storage capability is reported for a primary battery system having a lithium anode, a vanadium pentoxide (V2O5) cathode, and an electrolyte consisting of lithium hexafluoroarsenate (LiAsF6) plus lithium tetrafluoroborate (LiBF) in methyl formate. Also investigated was a simulated one-year requirement as a function of discharge rate and temperature, as well as storage time and temperature. Five cells were tested at each of 41 subtests, and the data were averaged. Average currents corresponded to the one-year rate and 5, 50, or 20 times the one-year rate. It was found that the system examined cannot meet performance requirements for a long-life, wide-temperature battery over the temperature range -54 C to +71 C, nor can it survive extended storage at elevated temperatures. ERA

N77-17569# Sandia Labs., Albuquerque, N.Mex.
ELECTRICAL AND ENVIRONMENTAL TESTING OF LITHIUM V2O5 CELLS. 2: TEMPERATURE AND SHOCK STUDIES
Samuel C. Levy 1975 9 p ref Presented at the 27th Power Sources Symp., Atlantic City, N.J., 21 Jun. 1976 Sponsored by ERDA
(SAND-75-5933; Conf-760617-2) Avail: NTIS HC A02/MF A01

A battery needed to furnish primary power for an instrumentation package has electrical requirements of 34 V maximum to 20 V minimum at 500 mA for three hours over a temperature range of -40 C to +70 C. The battery must be able to withstand a shock of 10,000 g's for 12 ms. Weight and volume restrictions require an energy density of approximately 33 Wh/kg (15 Wh/lb) and 79.3 Wh/d cum (1.3 Wh/cu in). The cell chosen for testing had a lithium anode, a vanadium pentoxide cathode, and an electrolyte of lithium hexafluoroarsenate plus lithium tetrafluoroborate in methyl formate. It was found that the applied shock has no effect on performance, other than an observed decrease of the standard deviation. Over the temperature range studied, performance increased linearly with temperature. The tested cells exceeded the system's electrical requirements at all test conditions. The cells are insensitive to shock levels up to 17,000 g's. ERA

N77-17570# Battelle Columbus Labs., Ohio.
SYSTEMS STUDY OF FUELS FROM SUGAR CANE, SWEET SORGHUM, AND SUGAR BEETS Quarterly Report
E. S. Lipinsky, Richard A. Nathan, Thomas A. McClure, Willian T. Lawhon, John Warner (C. Brewer and Company), William J. Sheppard, J. L. Otis, A. W. Lemmon, L. M. Curran, and J. H. Litchfield 14 Apr. 1976 149 p refs
(Contract E(11-1)-2762)
(TID-27032; QR-3) Avail: NTIS HC A07/MF A01

Methods to derive fuels economically from sugar cane, sugar beets, and sweet sorghum were suggested, potential feasibility of the various suggestions were evaluated, and means were suggested to convert the potential feasibility into practical feasibility. The sugar cane and sugar beet productivity per acre and the production costs are estimated. The two most promising methods for the thermochemical conversion of the plants into synthesis gas are the Bailie and the Purox process. ERA

N77-17571# Sandia Labs., Albuquerque, N.Mex.
SOLAR TOTAL ENERGY PROGRAM Semiannual Report, Oct. 1975 - Mar. 1976
G. W. Treadwell, ed. and L. E. Torkelson, ed. Jun. 1976 64 p refs
(Contract AT(29-1)-789)
(SAND-76-0205) Avail: NTIS HC A04/MF A01

Highlights of the period, descriptions of the system and its components, including recent modifications, and the results of systems analyses and component testing are included. ERA

N77-17572# Argonne National Lab., Ill.
HIGH-PERFORMANCE BATTERIES FOR OFF-PEAK ENERGY STORAGE AND ELECTRIC-VEHICLE PROPULSION Progress Report, Jan. - Jun. 1975
Mar. 1976 126 p refs
(Contract W-31-109-eng-38)
(ANL-75-36) Avail: NTIS HC A07/MF A01

The research and management efforts on high-performance lithium/metal sulfide batteries were reviewed. The batteries are developed for two applications, off-peak energy storage in electric utility networks and electric-vehicle propulsion. Recent effort in the development of engineering-scale cells was focused on designing and fabricating vertically oriented, prismatic cells and on improving the lifetime capabilities of cells. Work on electrode development was directed toward the evaluation of the factors that influence the performance of the negative electrode and the development of new designs of vertical, prismatic iron sulfide electrodes. ERA

N77-17573# Oak Ridge National Lab., Tenn.
POTENTIAL FOR ENERGY CONSERVATION TECHNOLOGY TRANSFER
E. C. Hise 1976 11 p refs Presented at Southern Interstate Nuclear Board Meeting, Winston-Salem, North Carolina, 24 May 1976 Sponsored by ERDA
(CONF-760536-1) Avail: NTIS HC A02/MF A01

The segment of energy consumption related to space conditioning and water heating in residential, commercial, and institutional buildings is discussed specifically. Within this constraint building energy consumption is discussed, considering three choices: drastic alteration of life style; even greater energy operating costs; or relatively large capital expenditures to reduce building energy consumption. It is concluded that the average existing residence can, through insulation, reduce its energy consumption to 60 percent of present for an expenditure of $500 to $1000 and a pay back of 5 to 10 years. The average existing commercial or institutional building can save even more. New construction can show greater energy savings at little or no additional construction cost. It is concluded that the average existing residential heating/cooling system (equipment) can be modified or replaced to reduce its energy consumption to 60 percent or even 40 percent of the present at a cost of a few hundred to $3000 as a function of the problem. ERA

N77-17574# Brookhaven National Lab., Upton, N.Y.
REFERENCE ENERGY SYSTEM METHODOLOGY
M. Beller Apr. 1976 11 p refs Presented at 81st Natl. Meeting of the Am. Inst. of Chem. Engr., Kansas City, Mo., 11 Apr. 1976 Sponsored by ERDA
(BNL-21079; Conf-760402-7) Avail: NTIS HC A02/MF A01

The Reference Energy System (RES) is a network representation of all of the technical activities required to supply various forms of energy to end-use activities. Analytical techniques are

described to examine all operations involving specific fuels including their extraction, refinement, conversion, transport, distribution, and utilization. Each of these activities is represented by a link in the network for which efficiency, environmental impact, and cost coefficients may be specified. The network is quantified for a given year with the level of energy demands and the energy flows through the supply activities that are required to serve those demands. RESs were developed for the years 1980, 1985, 1990, 2000, and 2020. The RESs are used in an assessment to evaluate new technologies by the techniques of perturbation analysis. The Brookhaven Energy System Optimization Model (BESOM) includes the same input parameters and can be used for more extensive analyses where optimization is desired. ERA

N77-17575# Energy Research and Development Administration, Washington, D.C. Div. of Buildings and Industry.
FEASIBILITY OF AN ENERGY OUTREACH PROGRAM Final Report
14 Jan. 1976 59 p refs
(ERDA-76-26) Avail: NTIS HC A04/MF A01

Target markets for energy conservation information and assistance were first identified and characterized and products of services to meet those markets needs were defined. Implementation of this approach involved seven major steps: segment the market; find a market niche; postulate a product line; conduct market research; define the product line; prepare the business plan; and analyze the return on investment. ERA

N77-17576# Sandia Labs., Albuquerque, N.Mex.
HEAT TRANSFER IN MAGMA BODIES
H. C. Hardee and D. W. Larson Mar. 1976 46 p refs
(Contract AT(29-1)-789)
(SAND-76-0011) Avail: NTIS HC A03/MF A01

Analytical heat transfer techniques are used to relate geological surface evidence and observations to conditions that are likely to exist in magma chambers. Resulting information is to be used for improving estimates of commercial heat extraction rates. The calculations indicate that an upward melting magma system is approximately equidimensional and that injected magmas with very high L/D ratios are likely formed by a forced intrusion process which involves little, if any, melting or natural convection. Calculations and surface heat flow measurements indicate that the steady-state heat extraction rates for shallow magma chambers with low superheat will probably be of the order of 10 kW./sqm or less. ERA

N77-17577# Brookhaven National Lab., Upton, N.Y.
COMPARING THE ELECTRIC LEAD-ACID BATTERY VEHICLE WITH A HYDROGEN FUELED VEHICLE INCORPORATING AN Fe-Ti HYDRIDE STORAGE UNIT
C. H. Waide 26 Jan. 1976 13 p refs Sponsored by ERDA
(BNL-20990) Avail: NTIS HC A02/MF A01

An electric vehicle powered by energy stored in lead-acid batteries is compared with a hydrogen fueled vehicle utilizing an internal combustion engine and iron-titanium hydride for the fuel storage. The comparison shows that for roughly equivalent vehicle types, the iron-titanium storage of hydrogen provides a vehicle with better range, better performance, and fewer operational limitations than an electric vehicle using lead-acid batteries. ERA

N77-17578# California Univ., Livermore. Lawrence Livermore Lab.
SOLAR POND FACILITY, BIBO, NEW MEXICO Final Report
1976 20 p refs Sponsored by ERDA
(UCRL-13680) Avail: NTIS HC A02/MF A01

The design and construction of a solar pond facility is described. The site of this facility is located on the L-Bar Ranch east of Bibo, New Mexico. The facility is designed to supply hot water for a uranium mill which Sohio presently has under construction at this location. ERA

N77-17579# Aerojet Nuclear Co., Idaho Falls, Idaho. National Engineering Lab.
CONCEPTUAL STUDY FOR TOTAL UTILIZATION OF AN INTERMEDIATE TEMPERATURE GEOTHERMAL RESOURCE
D. G. Swink and R. J. Schultz Apr. 1976 30 p refs Sponsored by ERDA
(Contract E(10-1)-1375)
(ANCR-1260) Avail: NTIS HC A03/MF A01

A multi-use, integrated project plan has been developed for the combined electrical and direct utilization of an intermediate temperature geothermal resource. This concept addresses an integrated project plan with industrial participation, which could make a significant contribution to the national plan for energy independence, by creating new and realistic energy choices for the immediate future. ERA

N77-17580# California Univ., Berkeley. Lawrence Berkeley Lab.
GEOTHERMAL COMPONENT TEST FACILITY
Apr. 1976 13 p
(Contract W-7405-eng-48)
(TID-27035) Avail: NTIS HC A02/MF A01

A description is given of the East Mesa geothermal facility and the services provided. The facility provides for testing various types of geothermal energy conversion equipment and materials under field conditions using geothermal fluids from three existing wells. ERA

N77-17581# California Univ., Livermore. Lawrence Livermore Lab.
PERFORMANCE TEST OF A BLADELESS TURBINE FOR GEOTHERMAL APPLICATIONS
R. Steidel and H. Weiss 24 Mar. 1976 24 p refs
(Contract W-7405-eng-48)
(UCID-17068) Avail: NTIS HC A02/MF A01

The Possell bladeless turbine was tested to evaluate its potential for application in the total flow process. Test description and performance data are given for 3000, 3500, 4000, and 4500 rpm. The maximum engine efficiency observed was less than 7 percent. It is concluded that the Possell turbine is not a viable candidate machine for the conversion of geothermal fluids by the total flow process. ERA

N77-17582# Michigan State Univ., East Lansing. Div. of Engineering Research.
APPLICATION STUDY OF WIND POWER TECHNOLOGY TO THE CITY OF HART, MICHIGAN
J. Asmussen, P. D. Fisher, G. L. Park, and O. Krauss 31 Dec. 1975 103 p refs
(Contract E(11-1)-2603)
(COO-2603-1) Avail: NTIS HC A06/MF A01

Information is presented concerning wind data collections and analysis; Hart power demand and consumer usage; wind power assessment; hydro power assessment; results of preliminary economics analysis; environmental impact of wind turbines and operation in the Hart, Oceana County, Michigan area; and systems model for the Hart power system with wind turbine. ERA

N77-17583# Grumman Aerospace Corp., Bethpage, N.Y.
INVESTIGATION OF DIFFUSER-AUGMENTED WIND TURBINES Progress Report, 25 Jun. - 24 Dec. 1975
R. A. Oman, K. M. Foreman, and B. L. Gilbert Jan. 1976 64 p refs
(Contract E(11-1)-2616)
(COO-2616-1) Avail: NTIS HC A04/MF A01

The diffuser-augmented wind turbine (DAWT) is one of the more promising advanced concepts for decreasing the cost of wind energy conversion. The most effective configurations for diffuser augmented wind turbines are investigated. Their ultimate performance in large units is assessed. Two types of compact diffusers were analyzed and tested, using screens to simulate the turbines. A 20 deg half-angle conical diffuser with two tangential boundary layer control slots provided a measured augmentation ratio of 1.7 at an area ratio of 2.8, while a double ring-wing diffuser gave 2.1 at an equivalent area ratio of 3.8. Results indicate potential for considerable improvement and further size reduction. Several analyses related to diffuser development are given. ERA

N77-17584# AEG-Telefunken, Hamburg (West Germany).
EXPERIMENTAL STUDY OF THE THEORETICAL AND TECHNOLOGICAL POSSIBILITIES TO MANUFACTURE SOLAR CELLS USING GaAlAs-LAYERS ON GaAs-STRUCTURES Final Report
Diethard Huber Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1976 44 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-2073; GfW-RV-11-TO-3/72)
(BMFT-FB-W-76-10) Avail: NTIS HC A03/MF A01 ZLDI, Munich, DM 8.85

Heterojunction solar cells, consisting of p-Ga(x)A(1-x)As-pGaAs-nGaAs were grown by liquid-phase epitaxy from Zn doped Al:GA:As melts. They exhibit power conversion efficiencies of 13.5% for air mass zero value. These values correspond to conversion efficiencies of 18% for air mass value of 1 or 20 to 22% for air mass value of 2 or more. The AlGaAs solar cells, published in the literature, are restricted with respect to optimizing power conversion efficiencies. These problems are discussed. An alternative structure of an AlAsP-GaAs solar cell has been proposed. Such a solar cell should have nearly no absorption in the window. Power conversion efficiencies of up to 20% for air mass zero value are possible with the proposed structure.
Author (ESA)

N77-17585# Battelle Inst., Frankfurt am Main (West Germany).
SODIUM AND SULFUR BATTERY RESEARCH AND DEVELOPMENT. SUBPROJECT: DEVELOPMENT OF INCONVENTIONAL PROCESSES FOR THE PRODUCTION OF THE SOLID BETA ALUMINA OXIDE ELECTROLYTE AND DEVELOPMENT OF THE SODIUM ELECTRODE Final Report, 1 May - 30 Sep. 1975
Werner Baukal, Sonja Ammende, Hans-Peter Beck, Hermann Doebrich, Ruediger Klawik, Reinhard Knoedler, and Wolfgang Kuhn Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1976 83 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-4483-G)
(BMFT-FB-T-76-40) Avail: NTIS HC A05/MF A01 ZLDI, Munich, DM 17.05

The development of processes for the production of the ceramic electrolyte beta alumina and the investigation of the sodium electrode are reported. Electrolyte: A process for the production of beta-alumina powder by thermal decomposition of a sprayed solution of nirates was developed and scaled up to an extended laboratory scale. Ceramic chips made of oxide powder produced by this method had a better microstructure than ceramic parts produced by conventional methods. An economic study of the new process showed that the additional costs (in comparison to the conventional process) are acceptable. Sodium electrode: It was found that the anode (molten sodium metal) can be immobilized by being sucked into a highly porous iron felt without substantial reduction of the electrical efficiency. Consequently, a new construction concept for the battery, with considerable advantages in regard to safety, weight, and corrosion, appears feasible.
Author (ESA)

N77-17586# European Space Research and Technology Center, Noordwijk (Netherlands). Spacecraft Power Supplies Div.
SPECIFICATION FOR SILICON SOLAR CELLS
Paris ESA 1 Jun. 1976 48 p
(ESA-PSS-25-ESTEC-Issue-1) Avail: NTIS HC A03/MF A01

The requirements for the qualification, procurement, storage and delivery of silicon solar cells for use in spacecraft applications are outlined. The general requirements are covered in the main part of the specification, the generic specification. Moreover, the recommended format for the specification of specific test and inspection data, physical and electrical characteristics and other ratings which are expected to be different for each application is included.
Author (ESA)

N77-17587# European Space Research and Technology Center, Noordwijk (Netherlands).
METEOSAT SOLAR-CELL ARRAY QUALIFICATION OF THE SUBSTRATE-TO-CELL ADHESIVE
G. Gourmelon Paris ESA Sep. 1976 36 p refs
(ESA-TM-159-ESTEC) Avail: NTIS HC A03/MF A01

Results of qualification tests are summarized. Data reported were obtained from tests on individual solar cells bounded to Kapton substrate.
ESA

N77-17588# Nuclear Regulatory Commission, Washington, D.C. Office of Nuclear Reactor Regulation.
MANUFACTURE OF FLOATING NUCLEAR POWER PLANTS BY OFFSHORE POWER SYSTEMS, DOCKET NO. STN 50-437. VOLUME 1, PART 2: A GENERIC ENVIRONMENTAL STATEMENT CONSIDERING THE SITING AND OPERATION OF FLOATING NUCLEAR POWER PLANTS Final Environmental Statement
Sep. 1976 696 p refs
(PB-258053/8; NUREG-0056-Vol-1-Pt-2) Avail: NTIS HC A99/MF A01; also available in set of two reports as PB-258076-SET. HC $25.25/MF $5.00 CSCL 18E

The environmental cost-benefit of the manufacture of eight floating nuclear plants that are affected by considerations associated with offshore siting and operation was analyzed. Environmental impacts related to the construction and operation of offshore nuclear power stations along the Atlantic and Gulf coasts ranging from the Gulf of Maine to the coast of Texas were focused on. The environmental feasibility of locating such plants offshore and assessing various environmental siting parameters that are related to plant design and the manufacture of the plants were discussed.
GRA

N77-17589# Nuclear Regulatory Commission, Washington, D.C. Office of Nuclear Reactor Regulation.
MANUFACTURE OF FLOATING NUCLEAR POWER PLANTS BY OFFSHORE POWER SYSTEMS, DOCKET NO. STN 50-437. VOLUME 2, PART 2: A GENERIC ENVIRONMENTAL STATEMENT CONSIDERING THE SITING AND OPERATION OF FLOATING NUCLEAR PLANTS Final Environmental Statement.
Sep. 1976 330 p refs
(PB-258054/6; NUREG-0056-Vol-2-Pt-2) Avail: NTIS HC A15/MF A01; also available in set of two reports as PB-258076-SET. HC $25.25/MF $5.00 CSCL 18E

A generic evaluation was made of the environmental impact and adverse effects of siting and operating floating nuclear power plants in the coastal zones of the Atlantic Ocean and the Gulf of Mexico. A consideration of principal alternatives was stimulated. Included are comments of governmental agencies and other organizations on the Draft Environmental Statement for this project, and staff responses to these comments.
GRA

N77-17590# Nuclear Regulatory Commission, Washington, D.C. Office of Nuclear Reactor Regulation.
OPERATION OF OFFSHORE POWER SYSTEMS FLOATING NUCLEAR PLANTS (1-8) DOCKET NUMBER STN 50-437
8 Oct. 1976 56 p
(PB-258748/3; NUREG-75/100-Suppl-2) Avail: NTIS HC A04/MF A01 CSCL 18E

Supplement No. 2 to the Safety Evaluation Report for the Offshore Power Systems' application for a license to manufacture eight standardized floating nuclear plants in a shipyard-like facility in Jacksonville, Florida has been prepared by the Office of Nuclear Reactor Regulation of the Nuclear Regulatory Commission. The purpose of this Supplement is to update the Safety Evaluation Report by providing the staff's evaluation of additional information submitted by the applicant since the issuance of Supplement No. 1 to the Safety Evaluation Report, and to address comments made by the Advisory Committee on Reactor Safeguards in its report dated June 7, 1976. Subject to favorable resolution of the items discussed in the Safety Evaluation Report and Supplement Nos. 1 and 2 thereto, the staff concludes that standarized floating nuclear plants can be constructed as proposed without endangering the health and safety of the public.
GRA

N77-17591# Nuclear Regulatory Commission, Washington, D.C. Office of Nuclear Reactor Regulation.
PRELIMINARY DESIGN OF THE GESSAR-238 NUCLEAR ISLAND STANDARD DESIGN. GENERAL ELECTRIC COMPANY, SUPPLEMENT NO. 1. DOCKET NO. STN 50-447 Safety Evaluation Report
Oct. 1976 65 p Supplement to NUREG-75/110
(PB-258234/4; NUREG-0124) Avail: NTIS HC A04/MF A01 CSCL 18E

The contents include: Introduction and general description of the plant; Design of structures, systems, and components; Reactor; Reactor coolant system; Engineered safety features;

Instrumentation and controls; Electrical power systems; Auxiliary systems; Radioactive waste management; Accident analysis; and Continuation of chronology of radiological review. GRA

N77-17592# Mobil Research and Development Corp., Princeton, N.J. Central Research Div.
THE NATURE AND ORIGIN OF ASPHALTENES IN PROCESSED COALS Annual Report
D. D. Whitehurst, M. Farcasiu, and T. O. Mitchell Feb. 1976 236 p refs
(PB-257569/4; EPRI-AF-252) Avail: NTIS HC A11/MF A01 CSCL 21D

The chemical nature and structure of solubilized coals are discussed. The kinetics and mechanisms by which these liquefaction products are formed from various coals under solvent refinishing (SRC) conditions are studied. Investigations were made under somewhat mild reaction conditions and at very low conversions, as well as under conditions typical of SRC pilot plant operations in order to be able to follow the solubilization process more closely. A much more detailed investigation of the skeletal structures and chemical functionality of products was pursued than has previously been performed. GRA

N77-17593# ICF, Inc., Washington, D.C.
PRODUCTION AND CONSUMPTION OF COAL, 1976 - 1980 Final Report
May 1976 167 p refs
(Contract FEA-C-05-50099-00)
(PB-257441/6; FEA/G-75/375) Avail: NTIS CSCL 21D

Independent forecasts are made for coal production and utility and nonutility consumption. Production relations are shown for consumption forecasts, future distribution patterns are projected, and excess production potential is estimated. GRA

N77-17594# Chem Systems, Inc., New York.
LIQUID PHASE METHANOL Annual Report
Martin Sherwin and David Blum Aug. 1976 112 p Sponsored by Elec. Power Res. Inst.
(PB-257615/5; EPRI-AF-202) Avail: NTIS HC A06/MF A01 CSCL 21D

A three phase fluidized system is described for methanol synthesis. An inert liquid is used as a sink for the exotherm of the synthesis reaction. This temperature control feature allows greater per pass conversion and improved thermal efficiency as compared to presently available technology. Experimental findings from a bench scale apparatus are reported. Thermodynamic calculations and a preliminary economic analysis are presented. This technology has potential as an efficient method of energy storage from coal-based gasification power plants. Another application is in a plant to produce fuel grade methanol for export to power plants for intermediate or peak load use. GRA

N77-17595# Babcock and Wilcox Co., Alliance, Ohio. Research Center.
INVESTIGATING STORAGE, HANDLING, AND COMBUSTION CHARACTERISTICS OF SOLVENT REFINED COAL Final Report
S. M. Barrick, S. J. Vecci, and C. L. Wagoner Aug. 1976 120 p refs Sponsored by Elec. Power Res. Inst. Prepared in cooperation with Babcock and Wilcox Co., Barberton, Ohio
(PB-257557/9; EPRI-1235-3-FR) Avail: NTIS HC A06/MF A01 CSCL 21D

The 1235 series of reports documents the results of the investigation of the storage, handling, and combustion characteristics of solvent refined coal (SRC). Such information would permit boiler manufacturers to design new units for burning SRC and to determine retrofit requirements (if any) for existing units burning coal. The SRC reports summarize activity for a wide range of tasks. Initial work included bench-scale analyses of SRC, such as fuel analysis, pulverizing, and transport. The culmination of the effort was a 2-ton/hour ball-and-race pulverizing and direct-firing test to simulate as closely as possible operating conditions in a utility plant using conventional equipment. GRA

N77-17596# GTE Labs., Inc., Waltham, Mass.
SEALED LITHIUM INORGANIC BATTERY Quarterly Report, 1 Jan. - 31 Mar. 1976
N. Marincic and A. Lombardi Aug. 1976 30 p refs
(Contract DAAB07-74-C-0108; DA Proj. 1S7-62705-AH-94) (AD-A028589; ECOM-74-0108-8; QR-8) Avail: NTIS HC A03/MF A01 CSCL 10/3

Studies were continued of the effects of hardware materials on the storage and discharge characteristics of Li/SOCl2 cells. Two effects were considered in particular: the ability of the hardware surface to carry the reduction of thionyl chloride when in contact with lithium (self discharge) and the corrosion of hardware materials resulting in the formation of soluble iron species and secondary iron deposits on the anode surface (anode passivation). The results are presented for 304 stainless steel, showing a significant rate of self discharge due to the reduction of thionyl chloride and an insignificant influence of the hardware corrosion on the anode passivation on storage. The tests with Kovar showed so far a negligible rate of iron generation in the electrolyte, when the Kovar hardware components are in contact with either lithium or carbon electrode. The tests in progress should show soon if Kovar is any different from the other materials in reducing thionyl chloride (self discharge) during storage at various temperatures. GRA

N77-17597# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
REFLECTANCE AND EMITTANCE OF SPECTRALLY SELECTIVE TITANIUM AND ZIRCONIUM NITRIDES Report on Investigations 1976
R. Blickensderfer, R. L. Lincoln, and D. K. Deardorff Aug. 1976 30 p refs
(PB-258109/8; BM-RI-8167) Avail: NTIS HC A03/MF A01 CSCL 10B

Spectrally selective solar absorbers were prepared by depositing a semiconductor film on a reflective base. Either zirconium compounds, or similar titanium compounds, or pure silicon were applied over a silver film. The zirconium-type absorber films were prepared by reactively sputtering or by oxidation of pure zirconium films in air. The effects of the composition and thickness of the film on spectral selectivity were determined. An emissometer is described for measuring normal total emittance up to 800 K. A calorimetric method for measuring solar absorptance, total hemispherical emittance, and their ratio at the stagnation temperature is described. GRA

N77-17598# Federal Energy Administration, Washington, D.C. Office of Energy Resource Development.
SUMMARY REPORT OF THREE POWERPLANT PRODUCTIVITY STUDIES
Robert M. Nelson Aug. 1976 86 p refs
(PB-257764/1; FEA/G-76/328) Avail: NTIS HC A05/MF A01 CSCL 10B

A summary of three separate studies of electric powerplant productivity is given. GRA

N77-17599# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH-EFFICIENCY THIN-FILM GaAs SOLAR CELLS Interim Report, 1 Apr. - 30 Jun. 1976
R. J. Stirn, Y. C. M. Yeh, and F. P. Ernest Jul. 1976 55 p refs
(Grant NSF AER-76-01823)
(PB-258493/6; NSF/RA-760237; IR-2) Avail: NTIS HC A04/MF A01 CSCL 10B

A program was begun to investigate the feasibility of growing large grain polycrystalline GaAs by chemical vapor deposition on recrystallized Ge films, to fabricate AMOS (Antireflection-Coated Metal-Oxide-Semiconductor) solar cells on the films, and to further investigate the physics of AMOS cells on single crystals. Progress was made in obtaining reproductibly high open-circuit voltages on oxidized single-crystal GaAs before contacting with grids or depositing AR coatings. Application of gold to the oxide film results in gold reaction with the film and apparent modification of the relative amounts of As(3+) to As(5+) in the oxide. Baseline and AMOS Schottky barrier solar cells were fabricated on polished wafers of polycrystalline GaAs with relatively high doping levels. Ge films recrystallized to date with focused IR line heaters melted over too large an area for zone recrystallization. A 10-watt CW Nd/YAG laser was requested in order to accomplish much finer zones of melting by line focusing with cylindrical lenses. GRA

N77-17600# National Bureau of Standards, Washington, D.C.
A SURVEY OF STATE LEGISLATION RELATING TO SOLAR ENERGY Final Report
Robert M. Eisenhard Apr. 1976 166 p refs Sponsored in part by ERDA and HUD
(PB-258235/1; NBSIR-76-1082) Avail: NTIS HC A08/MF A01 CSCL 10A

Enacted state legislation dealing with solar energy is reviewed. Acts involving tax incentives, reduced property assessments, research and development, solar easements and solar energy promotion are identified and abstracted. The responsible state agency and official are listed. Acts and supporting forms and other information are included. Portions of this document are not fully legible. GRA

N77-17601# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
MATERIALS FOR FUEL CELLS Quarterly Report, Feb. - Apr. 1976
L. H. Bennett, M. I. Cohen, A. L. Dragoo, A. D. Franklin, and A. J. McAlister Aug. 1976 39 p refs Sponsored by ERDA
(PB-257768/2; NBSIR-76-1091) Avail: NTIS HC A03/MF A01 CSCL 10B

Transition metal carbides, borides, and nitrides are being examined as potential hydrogen oxidation electrocatalysts for use in acid fuel cells. Preliminary screening of 19 carbides and borides has revealed apparent stability in hot (up to 160C) phosphoric acid for TaB, MoB, NbC, TaC, Mo2C, and WC. More sophisticated tests for acid stability for these materials are under way. Additional materials in the general refractory hard metal class, including a number of nitrides, have been ordered and will be screened for acid stability. More extensive exploration will be made of the properties of TaC and WC as a function of stoichiometry and presence of other metals and of oxygen. The current effort is devoted to improve and expanding the facility for electrochemical measurements. GRA

N77-17602# ESB, Inc., Raleigh, N.C. Wisco Univ.
AN 8-HOUR AN/SSQ53 LEAD CHLORIDE MAGNESIUM BATTERY Final Report, 15 Jul. 1975 - 15 May 1976
Alfred W. Jordan May 1976 18 p
(Contract N62269-75-C-0397)
(AD-A030105) Avail: NTIS HC A02/MF A01 CSCL 10/3

A program was undertaken to determine a workable design for an 8-hour life lead chloride-magnesium, seawater activated battery for use in the AN/SSQ53 sonobuoy. The major effort consisted of design and fabrication of prototype samples for testing followed by production of 50 samples for delivery to the Naval Air Development Center for evaluation. Results of these tests indicated that the battery design met all specification requirements with the exception of the minimum voltage of 11.0 volts at 180 seconds of discharge for batteries tested in 0C-1.5% salinity seawater. Voltage readings at 180 seconds of 4 samples tested cold ranged from 10.75 volts to 10.96 volts. This unreliable activation performance can be attributed to a high discharge current density (55ma/sq in.) in conjunction with variability in lead chloride cathode processing. It is recommended that additional volume be allowed for the battery, if possible, to reduce discharge current density to the range of 40 - 50 ma/sq in. Additional effort is also required to optimize the design and processing parameters of the lead chloride cathode. GRA

N77-17603# Energy Research Corp., Danbury, Conn.
FUEL CELL STACKS Interim Technical Report, Sep. 1975 - Feb. 1976
S. G. Abens and Bernard S. Baker May 1976 22 p
(Contract DAAK02-74-C-0367; DA Proj. 1T0-61102-A-34A)
(AD-A030375; ERC-7396-S-3; ITR-3) Avail: NTIS HC A02/MF A01 CSCL 10/3

Processes for the manufacture of phosphoric acid fuel cell components are described. Electrodes, matrices, and bipolar gas distribution plates for use in fuel cells with an active area of about 0.4 sq ft have been fabricated. Initial performance of 10-cell stacks has been studied with pure and CO-containing hydrogen fuel. Life testing has been conducted with pure hydrogen fuel with cell voltage decay rates of 1.5 mV/100 hours over the first 1000 hours of operation at 150 C. Author (GRA)

N77-17604# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
COMSAT NONREFLECTIVE SOLAR CELL EVALUATION Interim Report
David E. Joslin 16 Aug. 1976 18 p refs
(Contract F04701-75-C-0076)
(AD-A030532; TR-0076(6111)-7; SAMSO-TR-76-189) Avail: NTIS HC A02/MF A01 CSCL 10/2

The new COMSAT Nonreflective Cell is reported to have a greater airmass-zero efficiency than the COMSAT Violet Cell. The results of an evaluation of spectral response and diode characteristics of the new solar cell are described in this report. Author (GRA)

N77-17605# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SOLAR ENERGY STORAGE
Arthur Gauss, Jr. Jun. 1976 25 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A028083; BRL-1895) Avail: NTIS HC A02/MF A01 CSCL 10/3

Low temperature processes for solar energy storage have been evaluated. Temperatures are low enough so that relatively inexpensive flat plate solar collectors can be employed. Low temperature reactions are proposed which demonstrate the principles of chemical storage of solar energy. Certain of these reactions could be laboratory tested with little difficulty since they yield products which separate naturally. The most practical low temperature system analyzed to date is the heat of vaporization storage system. The storage capacity for this system, typically about 200 kcal/liter, is close to an order to magnitude better than conventional sensible heat storage in water. Author (GRA)

N77-17606# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
SEALED PRIMARY LITHIUM-INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Dec. 1975 - 29 Feb. 1976
A. N. Dey Aug. 1976 34 p refs
(Contract DAAB07-74-C-0109; DA Proj. 1S7-62705-AH-94)
(AD-A027959; ECOM-74-0109-8; QR-8) Avail: NTIS HC A03/MF A01 CSCL 10/3

The main objective of this program is to develop an all-inorganic electrolyte primary 'D' cell which is storable and operable in the temperature range of -40 to 160F and is capable of delivering in excess of 150 WHrs/lb at thirty hours rate and peak power density of 50 watts/lb. The authors showed earlier that the hermetic Li/SOCl2 D cell developed by them met all the above objectives. However, the cells suffered from two deficiencies: (a) explosion hazards and (b) voltage-delay problem. The authors investigated the explosion hazard problem in some detail earlier. At present they are concentrating on the voltage-delay problem. It was demonstrated that the voltage-delay problem was due to a Li anode film formed when Li comes in contact with the LiAlCl4-SOCl2 electrolyte. The Li film growth was studied in the above inorganic electrolyte having various salt concentrations and other additives using Scanning Electron Microscopic (SEM) Technique. It was found that the Li anode film grows in thickness with an increasing storage temperature and an increasing storage duration. GRA

N77-17690*# Boeing Co., Houston, Tex.
SPACE SOLAR POWER SYSTEMS
Curt Toliver *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 191-204 (For primary document see N77-17677 08-51)
Avail: NTIS HC A01/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-17607 California Univ., San Diego.
STATISTICAL MODELS FOR THE PREDICTION OF OXIDANT AIR QUALITY Ph.D. Thesis
Leik Norwald Myrabo 1976 167 p

Avail: Univ. Microfilms Order No. 77-521

A survey is presented of the state of the art of statistical/heuristic modelling of oxidant levels. Advantages and disadvantages of various short and long term forecasting models are discussed. A statistical computer based model for the prediction of oxidant air quality is described. This model forecasts changes in oxidant air quality as a function of location resulting from the creation of an indirect source or the implementation of a land use or transportation plan. The model is implemented for the San Diego-Tijuana region and for the South Coast Air Basin, which includes Los Angeles. Los Angeles and San Diego geocoded reactive hydrocarbon emission inventories from mobile and stationary sources for 1969 and 1970 are used with approximate wind data and observed oxidant air quality to calibrate a statistical relationship between emissions and air quality.

Dissert. Abstr.

N77-17608*# Columbia Univ., New York. Noise Research Unit.

A COMPARISON OF A LABORATORY AND FIELD STUDY OF ANNOYANCE AND ACCEPTABILITY OF AIRCRAFT NOISE EXPOSURES

Paul N. Borsky Washington NASA Feb. 1977 73 p refs (Grant NsG-1164)

(NASA-CR-2772) Avail: NTIS HC A04/MF A01 CSCL 20A

Residents living in close, middle and distant areas from JFK Airport were included in a field interview and laboratory study. Judgments were made of simulated aircraft noise exposures of comparable community indoor noise levels and mixes of aircraft. Each group of subjects judged the levels of noise typical for its distance area. Four different numbers of flyovers were tested: less than average for each area, the approximate average, the peak number, or worst day, and above peak number. The major findings are: (1) the reported integrated field annoyance is best related to the annoyance reported for the simulated approximate worst day exposure in the laboratory; (2) annoyance is generally less when there are fewer aircraft flyovers, and the subject has less fear of crashes and more favorable attitudes toward airplanes; (3) beliefs in harmful health effects and misfeasance by operators of aircraft are also highly correlated with fear and noise annoyance; (4) in direct retrospective comparisons of number of flights, noise levels and annoyance, subjects more often said the worst day laboratory exposured more like their usual home environments; and (5) subjects do not expect an annoyance-free environment. Half of the subjects can accept an annoyance level of 5 to 6 from a possible annoyance range of 0 to 9, 28% can live with an annoyance intensity of 7, and only 5% can accept the top scores of 8 to 9. Author

N77-17609*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A METHOD FOR AEROSOL ANALYSIS BY THERMOLUMINESCENCE Patent Application

Robert S. Rogowski and Edward R. Long, Jr., inventors (to NASA) Filed 29 Dec. 1976 16 p

(NASA-Case-LAR-12046-1; US-Patent-Appl-SN-755310) Avail: NTIS HC A02/MF A01 CSCL 13B

A method is described for detecting and measuring peak thermoluminescence of a test sample to serve as an aid in determining the source of aerosols in a specific geographic area. NASA

N77-17610# Oak Ridge National Lab., Tenn.

MODULAR INTEGRATED UTILITY SYSTEM (MIUS) AS A POTENTIAL INFLUENCE ON COMMUNITY DEVELOPMENT

W. R. Mixon 1976 18 p refs Presented at 5th Ann. Environmental Pollution Symp., Menlo Park, Calif., 12 May 1976 Sponsored by ERDA

(CONF-760534-1) Avail: NTIS HC A02/MF A01

The concept is described for a relatively small plant located within a community to furnish all electricity, space heating and cooling, solid and liquid waste disposal, and potable water within a total systems approach. The resource requirements of one utility are met by utilizing the effluent of another. Possible impacts on land use and community development are emphasized. ERA

N77-17611# Oak Ridge National Lab., Tenn.

ENVIRONMENTAL TRANSPORT MODELING OF POLLUTANTS IN WATER AND SOIL

M. R. Patterson, C. L. Begovich, and D. R. Jackson 1976 14 p refs Presented at Conf. on Pollutant Transport in Water and Soil, Washington, D. C., 11 May 1976 Sponsored by ERDA

(CONF-760512-1) Avail: NTIS HC A02/MF A01

A suite of models is discussed which can be applied to calculation of first order effects in transport of several types of pollutants in water and soil. The materials considered include solids in the form of particulates and soluble forms of the heavy metals. The time scale that is currently being emphasized is discussed, along with the physical size of the area covered by these calculations. The role of the hydrologic cycle is introduced along with the importance of bulk flow and particulate transport as suspended sediment. The build-up of lead, cadmium, zinc, and copper in the soil near a lead smelter over a six-year period is presented. ERA

N77-17612# Energy Research and Development Administration, Pittsburgh, Pa. Energy Research Center.

DETECTION OF POINT SOURCES OF AIR POLLUTION USING ERTS-1 DATA

F. R. Brown, F. S. Karn, and R. A. Friedel Mar. 1976 19 p refs

(PERC/RI-76/1) Avail: NTIS HC A02/MF A01

Earth Resources Technology Satellite (ERTS-1) imagery was used for the detection of specific sources of industrial air pollution. Particulate plumes and condensed water vapor plumes were detected when they were of sufficient size and when they were adequately contrasted with background features. Vegetation damage due to air pollution was not detected, but surface mining and coal storage could be identified. Industrial complexes that both produced and did not produce sighted plumes were located. ERA

N77-17613# Brookhaven National Lab., Upton, N.Y.

DEVELOPMENT AND APPLICATION OF SULFUR HEXAFLUORIDE MEASUREMENT CAPABILITIES AT BROOKHAVEN

Russell N. Dietz, Edgar A. Cote, and Robert W. Goodrich Mar. 1976 49 p refs Presented at the Symp. on the Develop. of Nuclear-based Tech., Vienna, 15 Mar. 1976; sponsored by IAEA

(Contract E(30-1)-16)

(BNL-21087; Conf-760311-6) Avail: NTIS HC A03/MF A01

The capability to determine sulfur hexafluoride in surface air samples with a few percent precision down to present ambient levels was clearly demonstrated. The most significant recent advancement was the development of portable real-time chromatographs which could continuously monitor SF6 for periods of more than 3 minutes. Author (GRA)

N77-17614# Battelle Pacific Northwest Labs., Richland, Wash.

GROWTH OF AEROSOL IN AN URBAN PLUME

A. J. Alkezweeny 1976 19 p refs Presented at the 12th Intern. Symp. on Atmospheric Pollution, Paris, 5 May 1976 Sponsored by ERDA

(BNWL-SA-5537; Conf-760519-1) Avail: NTIS HC A02/MF A01

Time changes of aerosol particle size distribution in the range of 0.01 micrometer diameter, concentration of O3, NO, NO2, SO2, several hydrocarbons, and sulfate were measured in an urban plume. The investigation was conducted in a Lagrangian frame of reference using instrumented aircraft. The air parcel trajectory was identified by the movement of a tetroon launched from the ground to an altitude within the plume. This study was carried out in metropolitan St. Louis, Missouri, U.S.A. The results of the measurement of trace gases and the aerosol particles and their chemical analyses are presented and discussed. ERA

N77-17615# Battelle Inst., Frankfurt am Main (West Germany). Abteilung Physikalische Verfahrenstechnik.

DEVELOPMENT OF X-RAY FLUORESCENCE EQUIPMENT FOR AUTOMATIC MULTIELEMENT ANALYSIS USING COMMERCIALLY AVAILABLE COMPONENTS Final Report

Hans-Ulrich Freund Bonn Bundesmin. fuer Forsch. u. Technol.

Oct. 1976 55 p refs In GERMAN; ENGLISH summary
(Contract BMFT-MF-149)
(BMFT-FB-M-76-01; BF-R-62.248-2) Avail: NTIS HC A04/MF A01 ZLDI, Munich, DM 11.55

X-ray fluorescence analysis using a semiconductor detector, known as energy dispersive X-ray fluorescence analysis, has been shown to be especially suited for rapid broad band element analysis of thin layered specimen. Work described demonstrates the advantages of this method for the analysis of marine samples. For this purpose an X-ray analysis setup with on line computer evaluation was developed. Samples of different masses and compositions may be analyzed. The equipment is portable.
Author (ESA)

N77-17616# Rockwell International Corp., Creve Couer, Mo. Air Monitoring Center.
REGIONAL AIR POLLUTION STUDY: GAS CHROMATOGRAPHY LABORATORY OPERATIONS Final Report
A. C. Jones and Raymond F. Mindrup, Jr., Jul. 1976 125 p refs
(Contract EPA-68-02-1081)
(PB-257165/1; EPA-600/4-76-040) Avail: NTIS HC A06/MF A01 CSCL 07D

The preparations and operations of a gas chromatography laboratory for analysis of atmospheric samples are described. Included are a work plan, chromatographic sampling and analysis schemes, quality assurance tests, and air sample bag storage and contamination tests. Atmospheric samples were analyzed for C1-C10 hydrocarbons, CO, NO + NO2, and total hydrocarbons. Additionally, analytical procedures were prepared and made operational for SO2, SF6, fluorocarbon -11, and fluorocarbon 12. GRA

N77-17617# General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
MONITORING GROUNDWATER QUALITY: ILLUSTRATIVE EXAMPLES Final Report
Richard M. Tinlin Jul. 1976 92 p refs
(Contract EPA-68-01-0759)
(PB-257936/5; GE75TMP-72; EPA-600/4-76-036) Avail: NTIS HC A05/MF A01 CSCL 13B

The report is designed to show by example site specific procedures for monitoring various classes of groundwater pollution sources. The first of five case histories of actual or potential groundwater pollution is presented with the monitoring techniques and their efficacy. The case history covers brine disposal in Arkansas, plating waste contamination in Long Island, New York, landfill leachate pollution in Milford, Connecticut, an oxidation pond near Tucson, Arizona, and multiple-source nitrate pollution in the Fresno-Clovis, California, metropolitan area. GRA

N77-17618# National Youth Advisory Board, Washington, D.C.
LAND USE AND ENVIRONMENTAL PROTECTION. AN OVERVIEW FOR ADDRESSING ENVIRONMENTAL PROBLEMS RESULTING FROM LAND USE PRACTICES IN THE UNITED STATES
1976 44 p Prepared in cooperation with EPA
(PB-258516/4) Avail: NTIS HC A03/MF A01 CSCL 13B

An attempt is made to summarize, in general terms, a study of public and private attitudes toward land and its use, shortcomings of traditional land use planning, the impact and role of governmental programs and policies on land use, and the relationship between land use and environmental quality. GRA

N77-17619# Department of City Planning, Los Angeles, Calif.
NOISE ELEMENT BACKGROUND REPORT AND PROPOSED FINAL ENVIRONMENTAL IMPACT REPORT, CPC-24875 Interim Report
Sep. 1976 79 p refs
(PB-258173/4) Avail: NTIS HC A05/MF A01 CSCL 13B

Various noise measurement scales and the effect of noise on hearing are discussed. Noise problems in Los Angeles are identified. Ambient and specific source noise are defined as they relate to land use. The city's noise ordinance (a complaint, not an abatement ordinance) is included. The appendix contains a number of methodologies for measuring noise levels. GRA

N77-17620# Texas A&M Univ., College Station. Environmental Engineering Div.
THE INTERRELATIONSHIP OF MATERIAL TOXICITY, STREAM PROPERTIES AND QUANTITY OF SPILLED MATERIAL IN ASSESSING THE RISK OF HAZARDOUS MATERIAL SPILLS
Paul Alfred Jensen and Roy W. Hann, Jr. May 1976 272 p refs
(Contract NOAA-04-3-158-18)
(PB-259098/2; TAMU-SG-75-212; NOAA-76071409) Avail: NTIS HC A12/MF A01 CSCL 13B

The current status of regulatory efforts for the bulk carriage of oil and hazardous materials is reviewed. The hazard posed to water resources is examined using the method of risk analysis. A weakness of the present regulatory efforts, namely that aquatic system properties and spill quantity are not considered is identified. With risk defined as the product of spill probability and severity, a procedure is suggested to better quantify severity of spill impact by identifying two major parameters which affect spill impact; concentration of material in the water, and the concentration at which the material causes acute toxic effects. The waterway relative dilution capacity quantification procedure is based on median discharge and considers the effects of longitudinal dispersion and the dynamics of fish mortality. GRA

N77-17621# Montana Univ., Missoula. Dept. of Chemistry.
REACTION KINETICS OF OZONE WITH SULFUR COMPOUNDS Final Report
Ronald E. Erickson and Leland M. Yates Aug. 1976 70 p refs
(Grant EPA-R-800655)
(PB-257891/2; EPA-600/3-76-089) Avail: NTIS HC A04/MF A01 CSCL 07C

The compounds of interest are sulfur dioxide, dimethyl sulfide, methanethiol and dimethyl disulfide. The rate of the reaction between ozone and dissolved sulfur dioxide is strongly pH dependent. This is so because sulfite ion reacts extremely rapidly (second order rate constant four orders of magnitude higher than that of bi-sulfite ion). These results suggest that under some conditions atmospheric oxidation of sulfur dioxide may involve ozone. GRA

N77-17622# Mitre Corp., McLean, Va.
EVALUATION OF SELECTED METHODS FOR CHEMICAL AND BIOLOGICAL TESTING OF INDUSTRIAL PARTICULATE EMISSIONS Final Report
H. Mahar May 1976 87 p refs
(Contract EPA-68-02-1859)
(PB-257912/6; EPA-600/2-76-137) Avail: NTIS HC A05/MF A01 CSCL 07D

Elemental analysis and partial organic characterization of the particulate samples were performed. A cellular bioassay, using rabbit alveolar macrophages, was used to provide a rank ordering of particulate samples in terms of their observed cytotoxic activity. A bacterial screening technique, using several histidine deficient Salmonella typhimurium strains, was used to study the mutagenic potential of the particulate samples. Attempts to correlate observed biological activity with chemical analyses are provided. GRA

N77-17623# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
SULFATE AND PARTICULATE EMISSIONS FROM AN OXIDATION CATALYST EQUIPPED ENGINE Final Report
Ander Laresgoiti and George S. Springer Jan. 1976 68 p refs
(Grant EPA-R-801476)
(PB-258291/4; EPA-460/3-76-021) Avail: NTIS HC A04/MF A01 CSCL 13B

Particulate and sulfuric acid emissions were studied in the exhaust of a production barrel engine with and without a pelleted and monolithic oxidation catalyst treating the exhaust. Particulates were collected at various points along a specially-constructed exhaust system. Total mass and the sulfuric acid content of the particulates were measured, as well as the percent conversion of fuel sulfur content into emitted sulfuric acid under variations in operating conditions. It was found that the total mass and sulfuric acid content of the particulates, as well as percent

conversion of fuel sulfur content, depend mostly on engine speed, catalyst temperature, and fuel-sulfur content. GRA

N77-17624# Industrial Environmental Research Lab., Research Triangle Park, N. C.
EPA FABRIC FILTRATION STUDIES. 2: PERFORMANCE OF NON-WOVEN POLYESTER FILTER BAGS Final Report, Jun. 1974 - Aug. 1975
G. H. Ramsey, R. P. Donovan (Res. Triangle Inst., Res. Triangle Park, N. C.), B. E. Daniel, and J. H. Turner Jun. 1976 37 p refs
(PB-258025/6; EPA-600/2-76-168-b) Avail: NTIS HC A03/MF A01 CSCL 13K

The testing consisted of simulating a baghouse operation in a carefully controlled laboratory setting that allowed measurement and comparison of bag performance and endurance. The simulation discussed in this paper covered only a very narrow range of operating conditions. The best performing spunbonded polyester bags significantly outperformed the woven polyester bags; they displayed higher efficiences, and lower cake resistances and effective drags. GRA

N77-17625# TRW Environmental Services, Redondo Beach, Calif.
UTILITY OF REACTIVITY CRITERIA IN ORGANIC EMISSION CONTROL STRATEGIES: APPLICATION TO THE LOS ANGELES ATMOSPHERE Final Report
John C. Trijonis and Kenneth W. Arledge Aug. 1976 236 p refs
(Contract EPA-68-02-1735)
(PB-257706/2; EPA-600/3-76-091) Avail: NTIS HC A11/MF A01 CSCL 13B

The impact of reactivity criteria is investigated on organic emission control strategies in the Metropolitan Los Angeles Air Quality Control Region. The investigation involved assembling data on total organic emission rates, on organic emission composition, and on emission reactivity for the Los Angeles basin. On the basis of this data, calculations were made of the degree to which each emission source type should be controlled to achieve the air quality standard for ozone/oxidant. Results were obtained and compared for the cases of indiscriminant control and of selective, reactivity-based control. GRA

N77-17626# Environmental Sciences Research Lab., Research Triangle Park, N.C. Meteorology and Assessment Div.
ATMOSPHERIC DISPERSION PARAMETERS IN GAUSSIAN PLUME MODELING. PART 2: POSSIBLE REQUIREMENTS FOR CHANGE IN THE TURNER WORKBOOK VALUES
F. Pasquill Jun. 1976 55 p refs
(PB-258036/3; EPA-600/4-76-030-b-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 13B

The basis of the original Pasquill-Gifford curves is restated and consideration given to those features of the curves which are now regarded as specially questionable. Data on crosswind spread from various field tests are reviewed to emphasize the useful working relation which holds between sigma(y) and the standard deviation of the wind direction fluctuation. Trial calculations of vertical spread are carried out in the light of recent work using the gradient transfer approach; recent similarity analyses, new observational data on the structure of turbulence in the convective boundary layer, and Deardoroff's modeling of the mixed layer. GRA

N77-17627# Environmental Sciences Research Lab., Research Triangle Park, N.C.
RAPID METHOD FOR DETERMINING, NOx EMISSIONS IN FLUE GASES Report, Sep. 1974 - May 1975
H. M. Barnes and M. C. Caldwell Aug. 1976 61 p refs
(PB-258309/4; EPA-600/2-76-094) Avail: NTIS HC A04/MF A01 CSCL 07B

The NOx compliance procedure (EPA method 7) for stationary sources is discussed. Attempts to improve the procedure and decrease analytical time are described. When the procedure is rigorously followed, Method 7 was found to be precise and to give reproducible results. To decrease the time necessary to oxidize NO to NO2, Method 7 was modified by adding an ozone lamp. Good agreement was found between nitrate measurements using Method 7, and measurements using modified Method 7. Future work incorporating an ozone lamp into an integrated sampling apparatus is discussed. GRA

N77-17628# Center for the Environment and Man, Inc., Hartford, Conn.
REFINEMENT AND VALIDATION OF AN URBAN METEOROLOGICAL-POLLUTANT MODEL Final Report, Feb. - Nov. 1976
Joseph P. Pandolfo, Clifford A. Jacobs, Robert J. Ball, Marshall A. Atwater, and Joseph A. Sekorsky Jul. 1976 32 p refs
(Contract EPA-68-02-1767)
(PB-258310/2; CEM-4182-542; EPA-600/4-76-037) Avail: NTIS HC A03/MF A01 CSCL 13B

Carbon monoxide concentrations in the Los Angeles metropolitan area were investigated. A 2 mile grid for the CO emission was used to test the hypothesis that predictive accuracy can be improved by incorporating a finer horizontal grid resolution to more accurately reflect the spatial distribution of a pollutant emission pattern. The evaluation statistics show that increasing the degree of horizontal detail in the source emission inventory did not significantly increase the sensitivity and accuracy of the pollutant concentration forecast. When compared to other models, this pollutant forecast is among the most accurate when predicting the overall average concentration and temporal correlation, and approximately as accurate as other primitive equation models in terms of spatial correlation statistics. GRA

N77-17629# National Bureau of Standards, Washington, D.C.
ACCURACY IN TRACT ANALYSIS. SAMPLING, SAMPLE HANDLING, ANALYSIS, VOLUME 1 Final Report
Philip D. Lafleur, ed. Aug. 1976 646 p refs Conf. Proc. of the 7th Materials Res. Symp., Gaithersburg, Md., 7-11 Oct. 1974
(PB-258091/8; NBS-SP-422-Vol-1; LCCCN-75-619250-Vol-1) Avail: NTIS HC A99/MF A01; also available in set of 2 reports as PB-258090-SET, HC $31.50/MF $5.00 CSCL 14B

A two volume set is prepared. The first volume contains the sections: General considerations, sampling, and part of the sample handling section. GRA

N77-17630# National Bureau of Standards, Washington, D.C.
ACCURACY IN TRACE ANALYSIS. SAMPLING, SAMPLE HANDLING, ANALYSIS, VOLUME 2 Final Report
Philip D. Lafleur, ed. Aug. 1976 636 p refs Conf. proc. of the 7th Materials Res. Symp., Gaithersburg, Md., 7-11 Oct. 1974
(PB-258092/6; NBS-SP-422-Vol-2; LCCCN-75-619250-Vol-2) Avail: NTIS HC A99/MF A01; also available in set of 2 reports as PB-258090-SET, HC $31.50/MF $5.00 CSCL 14B

A two volume set is prepared. The second part of the sample handling section, and the analysis section is given here. GRA

N77-17631# Syracuse Research Corp., N. Y. Center for Chemical Hazard Assessment.
INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: ACRYLAMIDES Final Report
Leslie N. Davis, Patrick R. Durkin, Philip H. Howard, and Jitendra Saxena Aug. 1976 159 p refs
(Contract EPA-68-01-3127)
(PB-257704/7; EPA-560/2-76-008; TR-76-507) Avail: NTIS HC A08/MF A01 CSCL 13B

Different aspects of the investigation are listed: (1) Physical and Chemical Data; (2) Structure and properties; (3) Chemistry; (4) Environmental Exposure Factors; (5) Production and consumption; (6) Uses; (7) Environmental contamination potential; (8) Current handling practices and control technology; (9) Monitoring and analysis; (10) Health and Environmental Effects; (11) Environmental effects; (12) Biological effects; and (13) Regulations and standards. GRA

N77-17632# Scott Environmental Technology, Inc., San Bernardino, Calif.
FIELD EVALUATION OF RED JACKET VAPOR CONTROL SYSTEM Final Report
Peter Westlin (EPA, Research Triangle Park, N. C.) Aug. 1976 66 p refs
(Contract EPA-68-02-1400)
(PB-257889/6; EPA-450/2-76-012) Avail: NTIS

HC A04/MF A01 CSCL 13B

The field evaluation of a Red Jacket aspirator assist vapor control system for motor vehicle refueling and a comparison with results from a test of a vapor balance system was described. Two different measurement approaches are compared and a combination of the two methods is used to calculate hydrocarbon emissions. Approximately 100 vehicles were used to test each system. Vent pipe emissions were determined and added to the total emissions calculations. GRA

N77-17633# Research Corp. of New England, Wethersfield, Conn.

EFFECTS OF POWER PLANT EMISSIONS ON MATERIALS

J. E. Yocom and N. Grappone Jul. 1976 92 p refs Sponsored by Elec. Power Res. Inst.

(PB-257539/7; EPRI-EC-139; EPRI/TPS-75-616) Avail: NTIS HC A05/MF A01 CSCL 13B

Knowledge on the effects of air pollutants on materials is assessed with special emphasis on those pollutants emitted from or related to emissions from fossil fuel power plants. The relative importance of these various effects is discussed, and current research on the material effects of air pollutions is summarized. Areas of needed research are identified. GRA

N77-17634# Office of Radiation Programs, Washington, D.C. Office of Radiation Programs.

PROGRAM STATEMENT

May 1976 52 p refs

(PB-258159/3; EPA-520/7-76-007) Avail: NTIS HC A04/MF A01 CSCL 13B

A continuing Federal overview of radiation protection philosophies, policies, and controls is presented. This is achieved by developing policies and controls based on the soundest available scientific and technical information, that satisfy the requirement and intent of the law, that are legally enforceable, and that reflect responsible public policy. GRA

N77-17635# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.

QUIETING: A PRACTICAL GUIDE TO NOISE CONTROL Final Report

Raymond D. Berendt, Edith L. R. Corliss, and Morris S. Ojalvo (NSF) Jun. 1976 165 p refs

(PB-258046/2; NBS-HB-119) Avail: NTIS HC A08/MF A01 CSCL 13B

Practical solutions are offered for ordinary noise problems that a person is likely to meet. Discussions are made of sound generation, transmission to the listener, and impacts on hearing and well being. Recommendations are made for controlling noise both at source and in travel, and for protecting the listener. Warning signs are noted that determine whether one is being subjected to hazardous prolonged noise. Remedies are suggested for home, work, and school, for traveling, and in the community. GRA

N77-17636# KVB Engineering, Inc., Tustin, Calif.

HOMOGENEOUS GAS PHASE DECOMPOSITION OF OXIDES OF NITROGEN Final Report

L. J. Muzio and J. K. Arand Aug. 1976 148 p refs Sponsored by Elec. Power Res. Inst.

(PB-257555/3; EPRI-FP-253) Avail: NTIS HC A07/MF A01 CSCL 13B

An alternative to limiting the formation of NOx through combustion modifications was studied. Results showing the effect of temperature, excess oxygen level, initial NOx level, and the amount of reducing agent injected are discussed. Measurements of the emissions of ammonia and cyanide are also presented. GRA

N77-17637# GCA Corp., Bedford, Mass. Technology Div.

PRELIMINARY EMISSIONS ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS, VOLUME 3

Norman Surprenant Aug. 1976 51 p refs Prepared for Ind. Environ. Res. Lab., Res. Triangle Park, N. C.

(Contract EPA-68-02-1316)

(PB-257849/0; GCA-TR-76-21-G-Vol-3; EPA-600/2-76-046-c) Avail: NTIS HC A04/MF A01 CSCL 13B

Major recent ongoing and proposed programs in the area of the pollutant emissions from combustion sources were identified. GRA

N77-17638# GCA Corp., Bedford, Mass. Technology Div.

ASSESSMENT OF ACRYLONITRILE AS A POTENTIAL AIR POLLUTION PROBLEM, VOLUME 6 Final Report

Robert M. Patterson, Mark I. Bornstein, and Eric Garshick Jan. 1976 28 p refs

(Contract EPA-68-02-1337)

(PB-258358/1; GCA-TR-75-32-G(6)-Vol-6) Avail: NTIS HC A03/MF A01; also available in set of 14 reports as PB-258352-SET, HC $40.50/MF $29.00 CSCL 13B

Acrylonitrile is toxic when inhaled, ingested, or absorbed through intact skin. It is a severe skin and eye irritant. Its high toxicity is due to the liberation of free cyanide in the body, which inhibits enzymes responsible for cellular respiration. The occupational standard for an 8-hour time weighted average is 20 ppm, based on animal studies and human data on hydrogen cyanide exposure. Based on the results of the health effects research presented and the ambient concentration estimates, it appears that acrylonitrile as an air pollutant does not pose a threat to the health of the general population. GRA

N77-17639# GCA Corp., Bedford, Mass. Technology Div.

ENVIRONMENTAL ASSESSMENT PERSPECTIVES Final Report

P. F. Fennelly, D. F. Durocher, A. S. Werner, M. T. Mills, S. M. Weinstein, A. H. Castaline, and C. Young Mar. 1976 248 p refs

(Contract EPA-68-02-1316)

(PB-257911/8; GCA-TR-75-21-G(2); EPA-600/2-76-069) Avail: NTIS HC A11/MF A01 CSCL 13B

The report: (1) defines environmental assessment (EA) programs and their role in energy system development; (2) indicates data requirements of an EA; (3) outlines exemplary methodologies for acquiring the necessary data; (4) serves as a technology transfer vehicle by providing background information on environmental monitoring and modeling, which can be used in EAs; (5) summarizes the extent, quality, applications, and location of existing information resources which can be used in the planning of EAs; and (6) summarizes existing or proposed standards and criteria for evaluating air, water, and land based pollution. GRA

N77-17640# Exxon Research and Engineering Co., Linden, N.J.

ASSESSMENT OF AUTOMOTIVE SULFATE EMISSION CONTROL TECHNOLOGY

K. C. Bachman, E. L. Holt, W. R. Leppard, and E. E. Wigg May 1976 217 p refs

(Contract EPA-68-03-0497)

(PB-257705/4; EPA-460/3-76-017) Avail: NTIS HC A10/MF A01 CSCL 13B

A literature search to determine possible reactions involving sulfur in automotive exhaust systems, an assessment of the effect of various operating parameters (i.e. exhaust oxygen level) on the level of sulfate emissions, and a feasibility study on the use of sorbents as traps to eliminate sulfate from the exhaust gas before release to the atmosphere are presented. It was discovered that exhaust oxygen level and catalyst age were major variables affecting level sulfate emissions. It was discovered that only calcium based materials (such as calcium oxide) removed sulfate efficiently enough with little physical degradation during laboratory testing of potential sorbents. Vehicle tests using the most promising sorbents as traps showed high sulfate removal but with unacceptably high exhaust back pressures. GRA

N77-17641# Environmental Sciences Research Lab., Research Triangle Park, N.C.

CONTINUOUS MEASUREMENT OF SULFUR IN SUBMICROMETRIC AEROSOLS Technical Report, Jun. 1974 - Jun. 1975

Jack L. Durham, William E. Wilson, and E. Baker Bailey (Northrop Services, Inc., Res. Triangle Park, N.C.) Aug. 1976 22 p refs

(PB-257543/9; EPA-600/3-76-088) Avail: NTIS HC A02/MF A01 CSCL 13B

A method is described for measuring continuously the total sulfur in submicrometric aerosols suspended in air containing

sulfur dioxide. The aero-colloid was passed through a tube coated internally with lead dioxide. The gaseous sulfur dioxide diffused to the surface of the tube and reacted irreversibly to form lead sulfate. The aerosol is not significantly removed in the tube. The total sulfur in the aerosol was determined by a hydrogen-air flame photometric detector. A sulfur balance was demonstrated for the sulfur dioxide-ozone olefine reaction system, which produced aerosols containing sulfur. GRA

N77-17642# Environmental Protection Agency, Washington, D.C.
NO SMALL TASK: ESTABLISHED NATIONAL EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS
Jun. 1976 16 p refs
(PB-258265/8) Avail: NTIS HC A02/MF A01 CSCL 13B

The Federal Water Pollution Control Act Amendments of 1972 initiated the world's most massive attack on polluted rivers, lakes and ocean waters. A system of limitations and permits is designed to help America reach two great goals of the 1972 Act -- by July 1983, water that is clean enough for swimming, boating, and protection of fish, shellfish and wildlife, and by 1985, no more discharges of pollutants into the Nation's water. A discussion of how effluent limitations guidelines and source performance standards for industry are put together, their complex nature, and the scope of their application to industry is presented. GRA

N77-17643# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
TECHNICAL REVIEW OF FEDERAL AVIATION REGULATIONS, PART 36. NOISE STANDARDS: AIRCRAFT CERTIFICATION
William J. Galloway and Dwight E. Bishop Mar. 1976 93 p refs Sponsored by EPA, Arlington, Va.
(PB-257717/9; BBN-2943-Pt-36) Avail: NTIS HC A05/MF A01 CSCL 13B

In compliance with the requirements of The Noise Control Act of 1972 the Environmental Protection Agency must review existing regulations and propose new regulatory action to the Federal Aviation Administration, where considered necessary, to control aircraft noise. Noise standards for turbine powered subsonic aircraft and subsonic transport aircraft are presented. Technical comment and analyses to support the EPA review of FAR 36 and its Appendices A, B, and C are included. GRA

N77-17644# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ANALYSIS OF THE PUBLIC HEALTH AND WELFARE EFFECTS OF EPA PROPOSED AIRCRAFT NOISE REGULATIONS
William J. Galloway Mar. 1976 40 p refs Sponsored by EPA, Arlington, Va.
(PB-257716/1; BBN-3171) Avail: NTIS HC A03/MF A01 CSCL 13B

A series of aircraft noise regulations was proposed by EPA to FAA for consideration under the procedures of the Noise Control Act. One of the components involved in these regulations is an assessment of their effect on reducing noise impact, i.e., the effect on public health and welfare if the regulations are implemented. Fractional impact analysis was used to assess several of the proposed regulations. The number of decibels that a noise exposure exceeds the identified levels specified in the EPA Levels report determines a fractional impact index. GRA

N77-17645# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
STATE IMPLEMENTATION PLAN EMISSION REGULATIONS FOR PARTICULATE MATTER: FUEL COMBUSTION Final Report
J. D. Crenshaw, C. H. Kuo (Mississippi State Univ., State College), and J. D. Potter Aug. 1976 81 p
(PB-257890/4; EPA-450/2-76-010) Avail: NTIS HC A05/MF A01 CSCL 13B

A one page summary of each state's implementation plan (SIP) regulations for particulate matter is presented. The relationship between the SIP regulations, the national ambient air quality standards, and the federal standards of performance for stationary sources are also reported. GRA

N77-17646# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
GUIDELINE FOR PUBLIC REPORTING OF DAILY AIR QUALITY: POLLUTANT STANDARDS INDEX (PSI) Final Report
William F. Hunt, Jr., Wayne R. Ott, John Moran, Raymond Smith, Gary Thom, Neil Berg, and Barry Korb Aug. 1976 44 p refs
(PB-257892/0; EPA-450/2-76-013; OAQPS-1.2-044) Avail: NTIS HC A03/MF A01 CSCL 13B

A guideline which suggests the use of an air quality index for those local and state air pollution control agencies wishing to report an air quality index on a daily basis is presented. The PSI places maximum emphasis on protecting the public health; that is, it advises the public of any possible adverse health effects due to pollution. The index incorporates five major pollutants: carbon monoxide, oxidants, particulates, sulfur dioxide, and nitrogen dioxide. 'Good' air quality falls in the 0 to 50 range, 'moderate' air quality from 50 to 100, 'unhealthful' from 100 to 200, 'very unhealthful' from 200 to 300, and 'hazardous' above 300. GRA

N77-17647# Environmental Protection Agency, Research Triangle Park, N.C. Emission Standards and Engineering Div.
STANDARDS SUPPORT AND ENVIRONMENTAL IMPACT STATEMENT. VOLUME 1: PROPOSED STANDARDS OF PERFORMANCE FOR PETROLEUM REFINERY SULFUR RECOVERY PLANTS
Sep. 1976 200 p refs 2 Vol.
(PB-257975/3; EPA-450/2-76-016-a-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 13B

A national emission standard for sulfur dioxide and reduced sulfur compound emissions from petroleum refinery sulfur recovery plants is proposed under authority of section 111 of the Clean Air Act. Reduced sulfur compound emissions reaches ambient levels sufficient to produce severe odor problems in the vicinity of a petroleum refinery in the absence of the standard. The proposed standard is to minimize reduced sulfur and sulfur dioxide emissions from refinery sulfur recovery plants to the level attainable with best available control technology. The standard is to have the effect of reduction emissions from a typical refinery sulfur recovery plant by 99.9%. Environmental impact and economic impact statements quantifying the impacts of the proposed standard and alternative control options are included. GRA

N77-17648# Spectron Development Labs, Inc., Tullahoma, Tenn.
ENVIRONMENTAL AEROSOL MEASUREMENTS USING AN AIRBORNE PARTICLE MORPHOKINETOMETER Final Report, Nov. 1975 - Feb. 1976
W. M. Farmer and J. O. Hornkohl Aug. 1976 96 p refs Sponsored by EPA
(Contract DA-6-99-2294A)
(PB-257514/0; EPA-600/3-76-087) Avail: NTIS HC A05/MF A01 CSCL 13B

Measurements of ambient aerosols using an airborne particle morphokinetometer are described. The measurements were of large particles (greater than 5 micrometers in diameter) in environmental aerosols around Phoenix, Arizona. Speed of the sample space on the airborne platform and time resolved measurements of relative particle number density and particle size distributions for horizonal and vertical flight profiles were obtained. The results show that the large aerosol particles were predominantly 50-75 micrometers in size, and that the largest concentration of particles were within 28 meters of ground level. GRA

N77-17649# Stanford Research Inst., Menlo Park, Calif. Center for Resource and Environmental Systems Studies.
SYSTEMS FOR RAPID BANKING OF ENVIRONMENTAL POLLUTANTS. SELECTION OF SUBJECTS FOR SCIENTIFIC AND TECHNICAL ASSESSMENT REPORTS Final Report
Stephen L. Brown, Buford R. Holt, and Kirtland E. McCaleb Aug. 1976 270 p refs
(Contract EPA-68-01-2940)
(PB-258168/4; CRESS-2) Avail: NTIS HC A12/MF A01 CSCL 13B

The results of the development and testing of a system for rapidly ranking environmental pollutants are reported. The system

defines procedures for collecting, processing, and evaluating data on production and use; environmental transport, transformation, and rate; and human health and welfare and ecological effects. A test of the objective subsystem confirmed the utility of the system. Of ten candidate agents, the three highest ranked were cyanides, carbon disulfide, and beryllium. GRA

N77-17650# Mitsubishi Heavy-Industries Ltd., Tokyo (Japan).
STUDY ON EXTREMELY LOW NOx BURNERS FOR CHEMICAL FURNACES
Yasuro Takahashi, Masayasu Sakai, Toshiyuki Takegawa, Katsuhiko Masuda, Kunio Minami, and Yoshio Miyairi Nov. 1976 7 p ref
(MTB-113) Avail: NTIS HC A02/MF A01

As a result of study on the NOx emission characteristics of premixed flames, we have succeeded in developing new extremely low NOx burners. These burners can be used for various kinds of chemical furnaces as gas and/or oil firing burners with a natural draft system. According to the results of tests of these burners in the semi-commercialized scale test furnace, their NOx emissions were very small, being 30 ppm in propane or naphtha firing, 45 ppm in light fuel oil firing and 90 ppm in heavy fuel oil firing (at the combustion of 5% excess oxygen). An outline of the construction of the burners and the results of tests in the test furnace are given. Author

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N77-17651 Denver Univ., Colo.
THE CHARACTERISTICS OF MAGNETOSPHERIC CONVECTIVE ELECTRIC FIELDS AS MAPPED ONTO THE POLAR CAPS Ph.D. Thesis
Ralph Stuart Saunders 1976 186 p
Avail: Univ. Microfilms Order No. 77-454

The objectives of the study are to demonstrate, using two numerical computer models, that steady state field line connection across the magnetopause is a possible mechanism for producing the polar cap electric fields detected there, and to show the interesting characteristics of such fields. A review of the literature pertinent to the polar cap electric fields is included. Author

N77-17652*# Ohio State Univ. Research Foundation, Columbus.
PROBABILISTIC AND DETERMINISTIC ASPECTS OF LINEAR ESTIMATION IN GEODESY Ph.D. Thesis
Athanasios Dermanis Oct. 1976 173 p refs
(Grant NGR-36-008-204; OSURF Proj. 3820-A1)
(NASA-CR-149521; Rept-244) Avail: NTIS HC A08/MF A01 CSCL 08E

Recent advances in observational techniques related to geodetic work (VLBI, laser ranging) make it imperative that more consideration should be given to modeling problems. Uncertainties in the effect of atmospheric refraction, polar motion and precession-nutation parameters, cannot be dispensed with in the context of centimeter level geodesy. Even physical processes that have generally been previously altogether neglected (station motions) must now be taken into consideration. The problem of modeling functions of time or space, or at least their values at observation points (epochs) is explored. When the nature of the function to be modeled is unknown. The need to include a limited number of terms and to a priori decide upon a specific form may result in a representation which fails to sufficiently approximate the unknown function. An alternative approach of increasing application is the modeling of unknown functions as stochastic processes. Author

N77-17653*# Control Data Corp., Minneapolis, Minn. Research Div.
A PRELIMINARY INVESTIGATION OF DOWNWARD COUPLING OF THE STRATOSPHERE AND THE TROPOSPHERE
G. S. Nastrom and A. D. Belmont 12 Jul. 1976 19 p refs
(Contract NAS6-2423)
(NASA-CR-141418; RR-3) Avail: NTIS HC A02/MF A01 CSCL 04A

Potential relationships between anomalies in the stratosphere and later anomalies at the surface at the same station are identified. The anomaly of October precipitation at mid and high latitude stations appears related to the date the fall reversal of zonal wind occurs; and the magnitude of the anomaly of surface temperature five or six months following a key month appears related to the stratospheric zonal wind speed during the key month. Both relations are statistically significant at the five percent level, and require more detailed analysis for possible use in long range forecasting. Author

N77-17654*# Transemantics, Inc., Washington, D.C.
CONCERNING THE GLOBAL INTERACTION OF THE ATMOSPHERE AND OCEANS
S. S. Zilitinkevich and A. S. Monin Washington NASA Dec. 1976 13 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, (USSR), v. 226, no. 6, 1976 p 1311-1314
(Contract NASw-2792)
(NASA-TT-F-17508) Avail: NTIS HC A02/MF A01 CSCL 04A

The characteristics of the interaction between the atmosphere and oceans are calculated from the formula for thermal wind and the equation for meridional heat transfer, where finite difference relations are substituted for the spatial derivatives. The theory developed is used to estimate, on the basis of external parameters, the climatic characteristics of the atmosphere and oceans as well as their small-scale interactions. The application of the theory is demonstrated. Author

N77-17655*# Scientific Translation Service, Santa Barbara, Calif.
STRATOSPHERIC OZONE
Stanislaw Cieslik Washington NASA Feb. 1977 35 p refs Transl. into ENGLISH from La Recherche, (Belgium), v. 7, Jun. 1975 p 510-519
(Contract NASw-2791)
(NASA-TT-F-17314) Avail: NTIS HC A03/MF A01 CSCL 04A

Models proposed for the formation and destruction of stratospheric ozone are reviewed. Techniques and models used by the climatic impact assessment program (CIAP) to investigate the possible effect of the proposed Boeing supersonic transport on the ozone layer are discussed in detail. Possible sources of error in the results reported by CIAP are examined. The potential threat to the ozone layer posed by freons and chlorine compounds is considered. Author

N77-17656# Oak Ridge National Lab., Tenn.
ANALYTICAL ANALYSIS OF SOIL-MOISTURE AND TRACE-CONTAMINANT TRANSPORT
N. M. Larson and M. Reeves Mar. 1976 180 p refs
(Contract W-7405-eng-26)
(ORNL/NSF/EATC-12) Avail: NTIS HC A09/MF A01

A transport model is presented which predicts the coupled movement of both water and trace contaminants through a layered and unsaturated soil-moisture zone. In order to achieve computation speeds suitable for watershed implementations, moisture properties are approximated as exponential functions of pressure head, and lateral flows are treated as sinks in a basically vertical one-dimensional analysis. In addition, only advection by the Darcy-flow velocities and linear adsorption by the soil matrix are considered in depicting movement of the trace contaminant. Formal solution of the resulting transport equations is obtained through use of both eigenfunctions-expansion and coordinate-transformation methods. Numerical solution is effected by means of a program written in FORTRAN 4 and implemented on an IBM 360/91 computer. Two example calculations illustrate both strengths and weaknesses of our model. Author

N77-17657# Oak Ridge National Lab., Tenn.
SYNTHESIS OF SMOOTH SPECTRA-COMPATIBLE ACCELEROGRAMS FOR SEISMIC ANALYSIS
T. G. Carley 1976 19 p refs Presented at 8th Southeastern Conf. on Theoretical and Applied Mechanics, Blacksburg, Va., Apr. 1976 Sponsored by ERDA
(CONF-760404-3) Avail: NTIS HC A02/MF A01

The development of a methodology to produce a ground motion time-history, the ground response spectrum of which is compatible with a specified design response spectrum, is described. ERA

N77-17658# Royal Aircraft Establishment, Farnborough (England).
UPPER-ATMOSPHERE ZONAL WINDS: VARIATION WITH HEIGHT AND LOCAL TIME
D. G. King-Hele and Doreen M. C. Walker May 1976 54 p refs
(RAE-TR-76055; BR52826) Avail: NTIS HC A04/MF A01

The average rotation rate of the upper atmosphere can be found by analysis of the changes in the orbital inclinations of satellites; results previously obtained have indicated that the atmospheric rotation rate appreciably exceeds the earth's rotation rate at heights between 200 and 400 km. All such results previously published are examined in the light of current standards of accuracy: some are accepted, some revised, and some rejected as inadequate in accuracy. A number of fresh orbits were also analyzed and, adding these to the accepted and revised previous results, the variation of zonal wind speed with height and local time is derived. The rotation rate (rev/day) averaged over all local times increases from near 1.0 at 150 km height to 1.3 near 350 km (corresponding to an average west-to-east wind of 120 m/s), and then decreases to 1.0 at 400 km and probably to about 0.8 at greater heights. The maximum west-to-east winds occur in the evening hours, 18 to 24 h local time: these evening winds increase to a maximum of about 150 m/s at heights near 350 km and decline to near zero around 600 km. In the morning, 4 to 12 h local time, the winds are east to west, with speeds of 50 to 100 m/s above 200 km. It is tentatively concluded that, at heights above 350 km, the average rotation rate is greater in equatorial latitudes (0 to 25 deg) than at higher latitudes. Author (ESA)

N77-17659# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
THE GRIM 2 EARTH GRAVITY FIELD MODEL
Georges Balmino, Christoph Reigber, and Bernard Moynot Bayerische Akad. der Wissenschaften Jul. 1976 34 p refs Prepared jointly with Groupe de Rech. de Geodesie Spatiale, CNES, Toulouse, and Tech. Univ. Munich
(Ser-A-86; ISBN-3-7696-8170-3) Avail: NTIS HC A03/MF A01

A new geopotential model, GRIM 2, was computed, using most of the optical and laser observations made on major geodetic satellites as well as all gravimetric informations now available on a 1 deg x 1 deg basis. Zonal harmonics Clo have been computed up to l=23, and tesseral harmonics up to l=m=30. The model also includes the coordinates of 38 stations. This model is much better than the previously published GRIM 1 (which was a limited satellite solution) for satellite orbit computation, geoid heights representation, and station coordinates consistency in major datums. All tests made so far have indicated that this solution is close to the recent GEM 8 model computed at the Goddard Space Flight Center: satellite orbit representation on long arcs is often better with GRIM 2, and the geoid profiles are in very good agreement with the 1975 Vincent and Marsh gravimetric geoid. Author (ESA)

N77-17660# Naval Surface Weapons Center, White Oak, Md.
DETERMINATION OF THE MAGNETIC FIELD BENEATH A PLANE BY MEASUREMENT OF OBLIQUE FIELD COMPONENTS ON THE PLANE
Joel C. W. Rogers 25 Mar. 1976 28 p refs
(SF33351503)
(AD-A028929; NSWC/WOL/TR-76-28) Avail: NTIS HC A03/MF A01 CSCL 20/3

The problem of finding a magnetostatic field below a plane in the absence of currents is reduced to the solution of a partial differential equation with given boundary conditions. The problem is solved when the boundary conditions can be expressed in terms of values of an oblique component of the field on the plane. The question of the relation between accuracy of field prediction and error in field measurement on the plane is taken up. The case when the measured field component is tangent to the plane receives special consideration. Recommendations for further work are made. Author (GRA)

N77-17661# Fleet Weather Facility, Suitland, Md.
A PRACTICAL METHOD OF LONG RANGE ICE FORECASTING FOR THE NORTH COAST OF ALASKA, PART 1
Don G. Barnett Mar. 1976 21 p
(AD-A027841; FLEWEAFAC-TR-1-Pt-1) Avail: NTIS HC A02/MF A01 CSCL 08/12

The report describes observed relationships between April mean pressure patterns in Siberia and the Alaskan Arctic and summer ice conditions in the shipping lanes along the North Coast of Alaska. A long range ice forecasting method, based on these relationships, is introduced in its preliminary state. Also presented is a graphical display of the cyclical nature of ice conditions along the Alaskan North Coast between 1953 and 1975. Author (GRA)

N77-17662# Hawaii Inst. of Geophysics, Honolulu.
RAYLEIGH WAVES Final Report, 1 Oct. 1973 - 31 Mar. 1976
Eduard Berg May 1976 64 p refs
(Grant AF-AFOSR-2612-74; ARPA Order 1827)
(AD-A028331; AFOSR-76-0842TR) Avail: NTIS HC A04/MF A01 CSCL 08/11

For a signal-to-noise ratio between 0.2 and 0.1 on the original single-component records, amplitudes for Rayleigh waves over oceanic paths of 155 deg at station MAT and 98 deg at station KIP have been determined as 12 mu and 24 mu peak-to-peak, respectively, with a standard error of less than 11 per cent. In each case the processed correlation signal is the highest in a half-hour record. The method makes use of preliminary high-pass filtering and normalized reference earthquake-matched filtering, and takes full advantage of the well-dispersed oceanic surface wave. The method also provides high resolution of co-located events with short time separation, or of widely spaced events with Rayleigh waves arriving nearly simultaneously at a single station, when the summed vertical and radial matched filtered components are used. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-17663 Florida State Univ., Tallahassee.
DETERMINATION OF THE VERTICAL DISTRIBUTION OF OZONE WITH SIMULTANEOUS UMKEHR-OZONESONDE OBSERVATIONS OVER TALLAHASSEE, FLORIDA Ph.D. Thesis
Mark Alan Scruggs 1976 117 p
Avail: Univ. Microfilms Order No. 76-29482

The procedure makes use of ozonesonde measurements, assumed accurate to within a multiplicative constant, to represent the ozone distribution up to an artificial balloon ceiling near 24 km. The Umkehr observations are used to deduce the ozone distribution above the balloon ceiling and to determine the multiplicative constant needed to adjust the absolute calibration of the balloon measurements below. The mathematical technique employs established non linear least squares regression analysis for ill-conditioned systems. An independent total ozone observation is used as a strong constraint on the system of equations. Dissert. Abstr.

N77-17664*# Kanner (Leo) Associates, Redwood City, Calif.
A REMARKABLE CHANGE IN CLIMATE OVER NORTHERN EUROPE
R. Scherhag Washington NASA Feb. 1977 11 p refs Transl. into ENGLISH from Annalen der Hydrographie und Maritimen Meteorologie (W. Germany), v. 64, no. 3, Mar. 1936 p 96-100
(NASA-TT-F-17378) Avail: NTIS HC A02/MF A01 CSCL 04B

The unusual increase in winter temperatures over Greenland, the Greenland Sea, and the East Spitzbergen Sea is

studied, and it is demonstrated that the change in climate is associated with a considerable recession in the ice limit and an appreciable increase in atmospheric circulation. Author

N77-17665*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETERMINATION OF THE HEAT BALANCE OF THE EARTH: INTERPRETATION OF RADIATION MEASUREMENTS FROM SATELLITES
Charles R. Laughlin Washington Feb. 1977 24 p refs
(NASA-TR-R-471; G-7902) Avail: NTIS HC A02/MF A01 CSCL 04B

A method is developed for estimating the mean and mean-square variation of the flux at an altitude arbitrarily chosen to represent the top of the atmosphere. When applied to practical satellite measurements, the method is shown to be optimum in that the estimated mean is unbiased and the mean square variation of the estimates converges to that of the true flux. Data from the Meteor-1 and -2 satellites support the essential assumptions and provide a quantitative indication of the performance that can be expected. Author

N77-17666*# Utah Univ., Salt Lake City. Dept. of Meteorology.
CHARACTERISTICS OF THE MOTIONS, TURBULENCE INTENSITY, DIFFUSIVITY, FLUX OF MOMENTUM AND SENSIBLE HEAT IN THE UPPER ATMOSPHERE
S. K. Kao and N. J. Lordi Washington NASA Feb. 1977 58 p refs
(Contract NAS6-2498)
(NASA-CR-2782) Avail: NTIS HC A04/MF A01 CSCL 04B

Analyses of the meteorological rocket data obtained from an experiment conducted at 3-hour inervals at 8 western meridional rocket stations are presented. Large variations in the meridional wind contribute substantially to overall turbulence in the tropical stratosphere. The solar semidiurnal component of wind oscillations in the tropics was observed to be much higher than predicted by theory, often exceeding the magnitude of the diurnal amplitude throughout the stratosphere. The observed value of the solar diurnal amplitude in the stratosphere was in line with theoretical prediction. The solar terdiurnal amplitudes for temperature, meridional and zonal winds were non-negligible and must be considered in any harmonic analysis. Phase angle variation with height was rapid for all harmonics; however, there was general agreement between predicted and observed phase angles. Because of large changes in the mean winds in the mesosphere with season, harmonic determinations are difficult. There appear to be large zonal wind changes even within the same season as mentioned previously. Turbulence diffusivity in the upper stratosphere is greater near the equator than in the mid-latitudes. Author

N77-17667# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: GLOBAL OBSERVING SYSTEM - SATELLITE SUB-SYSTEM. INFORMATION ON METEOROLOGICAL SATELLITE PROGRAMMES OPERATED BY MEMBERS AND ORGANIZATIONS
Jun. 1976 22 p
(WMO-411-Suppl-3) Avail: NTIS HC A02/MF A01
For abstract, see N76-19207.

N77-17668# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE TWELFTH SESSION OF THE JOINT ORGANIZING COMMITTEE Global Atmospheric Research Program
Jun. 1976 200 p Conf. held at Nairobi, Kenya, 24-30 Jun. 1976 Prepared jointly with ICSU, Rome
Avail: NTIS HC A09/MF A01; WMO, Geneva

The following topics were discussed: a numerical experimentation program; the GARP climate dynamics subprogram; the global experiment; other GARP subprograms and related projects; the oceanographic program within GARP; and the organization of future work. Annexes cover various working GARP reports on numerical experimentation and other studies. ESA

N77-17669# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE PLANNING MEETING FOR THE MONSOON-77 EXPERIMENT Global Atmospheric Research Program
May 1976 41 p Conf. held at Colombo, Sri Lanka, 17-21 May 1976 Prepared jointly with ICSU, Rome
(GARP-Spec-Rept-21) Avail: NTIS HC A03/MF A01; WMO, Geneva

Following a general summary and conclusion of the meeting, reviews of the GARP monsoon subprogram, preliminary results of ISMEX-73, and scientific objectives of Monsoon-77 are given. The observing and data management system are discussed together with the oceanographic and research programs. Implementation plans, time schedule, and material contribution are also noted. ESA

N77-17670# National Hurricane and Experimental Meteorology Lab., Coral Gables, Fla.
THE 1975 FLORIDA AREA CUMULUS EXPERIMENT (FACE): OPERATIONAL SUMMARY Final Summary Report
Jun. 1976 188 p refs Prepared in cooperation with NOAA, Boulder, Colo.
(PB-259252/5; NOAA-TM-ERL-WMPO-28; NOAA-76072102) Avail: NTIS HC A09/MF A01 CSCL 04B

A final and detailed summary of all aspects of FACE 1975 is discussed. In it, an attempt was made to assess the achievements of each subprogram. Highlights, milestones and problem areas are treated -- the lessons learned and the outlook for the future are discussed. The project consisted of the Core Seeding Program, concerned with randomized dynamic cumulus seeding, and 10 related subprograms. GRA

N77-17671# Maryland Univ., College Park. Computer Science Center.
AN APPROACH TO SELECTION OF WIND TRACERS FROM TROPICAL MARITIME GEOSYNCHRONOUS SATELLITE CLOUD IMAGERY
JoAnn Parikh Mar. 1976 41 p refs
(Contract F44620-72-C-0062; AF Proj. 9769)
(AD-A028096; TR-450; AFOSR-76-0875TR) Avail: NTIS HC A03/MF A01 CSCL 04/2

Manual and automatic procedures for obtaining wind estimates from geosynchronous, dual-channel satellite cloud imagery are reviewed as background material for a proposed automatic system of extracting upper-level wind estimates from tropical maritime regions containing cirrus and low-level clouds. The manual procedures for satellite photointerpretation are subdivided into two stages: (1) determination of cloud genus based on textural and tonal characteristics and on known relationships between synoptic and cloud features, and (2) selection of cloud targets based on cloud genus, reliability of emissivity estimate for the target, and conformity of motion with advective mechanisms. A summary of the automatic operational system of NESS for low-level wind estimation and its extension to upper-level wind estimation is presented. A model for obtaining upper-level wind estimates is proposed. GRA

N77-17672# California Univ., Los Angeles. Dept. of Atmospheric Sciences.
TWO-MONTH OSCILLATION OF GEOPOTENTIAL HEIGHT AND WIND IN THE TROPIC PACIFIC AND LARGE-SCALE TROPOSPHERIC RESPONSE TO ANOMALOUS TROPICAL SEA-SURFACE TEMPERATURES DURING THE WINTERS OF 1962 - 1966, VOLUME 1 Final Report, Dec. 1972 - Jun. 1976
Tan-Na Lee and Donald J. Boucher, Jr. Jun. 1976 77 p refs
(Contract N00014-75-C-0262; NR Proj. 083-287)
(AD-A028085) Avail: NTIS HC A05/MF A01 CSCL 04/2

Spectral analysis of 1962-1963 daily rawinsonde data for Canton Island (3 S, 172 W) has revealed significant peaks in the geopotential height and zonal wind spectrum. A period of 57 days is observed for the geopotential oscillation and 50 days for that of the zonal wind. Both oscillations are confined to the lower and upper levels of the troposphere with the middle level (300-500 mb) acting as a 'buffer zone' (i.e. no significant peaks found in the middle level). Variations in sea-surface temperature from long-term means were found to have a pronounced effect

on the amplitudes of the two month oscillation. Anomalously warm sea-surface temperatures intensify amplitudes of zonal and meridional winds along with the temperature wave. They will, however, reduce the geopotential height amplitude. Subsequent co-spectrum analysis of u and v components yields a strong negative peak at a period of two-months, indicating southward momentum transport. Conversely, an anomalously cool sea-surface will reduce the zonal wind amplitude variations and eliminate the two-month cycle in the meridional wind and temperature wave. The two-month geopotential oscillation is a basic feature of all years analyzed (1962-1967), having a maximum amplitude in '62-'63 GRA

N77-17673# Air Force Geophysics Lab., Hanscom AFB, Mass.
ESTIMATES FROM SATELLITES OF TOTAL ICE AND WATER CONTENT OF CLOUDS Interim Report
James T. Bunting and John H. Conover 13 Jul. 1976 7 p refs
(AF Proj. 6698)
(AD-A027926; AFGL-TR-76-0150) Avail: NTIS HC A02/MF A01 CSCL 04/2

Empirical methods for estimating cloud top heights and cloud ice and water content from satellite data have been developed. The satellite information used consisted of visible and infrared window channel scanning radiometer (SR) data as well as radiances from the 15 micron CO2 band measured by the Vertical Temperature Profile Radiometer (VTPR). This information was correlated with observations from an aircraft which simultaneously sounded the clouds. The aircraft was equipped with foil samplers, replicators, Knollenberg particle counters, etc. Data from these instruments were used to construct verticle profiles of ice and water content. Application of the relationships of these profiles to routine satellite data makes it possible to construct cloud top topography and ice and water content of entire storm systems. Since the satellite data have been archived for several years, it is also possible to derive climatologies of these cloud parameters over large areas. Author (GRA)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-17674# Skidaway Inst. of Oceanography, Savannah, Ga.
CONTINENTAL SHELF PROCESSES AFFECTING THE OCEANOGRAPHY OF THE SOUTH ATLANTIC BIGHT, PART 1 Annual Report, 1 Jun. 1975 - 31 May 1976
Larry P. Atkinson 12 Mar. 1976 16 p
(Contract E(38-1)-889)
(SRO-899-1-Pt-1) Avail: NTIS HC A02/MF A01

A full scale experiment was done in Onslow Bay in September 1975 and data acquired forms the principal scientific results. Data reports and publications are attached. The accomplishments, scientific and otherwise, are summarized followed by a more lengthy discussion and appendices. GRA

N77-17675# Skidaway Inst. of Oceanography, Savannah, Ga.
CONTINENTAL SHELF PROCESES AFFECTING THE OCEANOGRAPHY OF THE SOUTH ATLANTIC BIGHT, PART 2. HYDROGRAPHY OF ONSLOW BAY, NORTH CAROLINA: SEPTEMBER 1975 (OBIS II)
Larry P. Atkinson, J. J. Singer, W. M. Dunstan, and L. J. Pietrafesa 12 Mar. 1976 152 p refs
(Contract E(38-1)-889)
(SRO-889-1-Pt-2) Avail: NTIS HC A08/MF A01

Over the course of OBIS II, 3-14 September, two intrusion cores were observed. One was apparently trapped nearshore over much of the study period, but as time went on, it either dissipated, moved too far shoreward or moved too far laterally along the shelf to be detected by the existing observational grid. The other (later) intrusion was first detected on 5-7 September and was observed to be moving into the Bay from the southeast over the remainder of the study period. Plots of the horizontal temperature and salinity distribution were suggestive of these phenomenon by means of the higher salinity-lower temperature relationship. However, the real confirmation rests in the vertical distributions of sigma-t and chlorophyll presented in conjunction with the Bio and Hydrogrids, and the T-S plot which reveals slope waters on the shelf. The intruded waters were not of low enough temperature to carry high nutrient concentrations onto the shelf for study. ERA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-17676*# Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Jul. - 30 Sep. 1976
A. L. Reyes, J. E. Campbell, A. J. Wehby, R. G. Crawford, J. C. Wimsatt, and J. T. Peeler Dec. 1976 9 p
(NASA Order W-13411)
(NASA-CR-149658; QPR-46) Avail: NTIS HC A02/MF A01 CSCL 06M

Experiments performed on the heat resistant organism CK 4-6 are described. Its response to dry heat at two temperatures (125 C and 135 C) at eight humidity levels (<0.001 percent to 100 percent RH) in a closed can system is studied. Author

N77-17677*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BIOPROCESSING IN SPACE
Dennis R. Morrison, comp. Jan. 1977 217 p refs Conf. held at Houston, Tex., 10-12 Mar. 1976
(NASA-TM-X-58191; JSC-11582) Avail: NTIS HC A10/MF A01 CSCL 06B

Proceedings are presented of the 1976 NASA Colloquium on bioprocessing in space. The program included general sessions and formal presentations on the following topics: NASA's Space Shuttle, Spacelab, and space-processing programs; the known unusual behavior of materials in space; space-processing experiment results; cell biology, gravity sensors in cells, space electrophoresis of living cells, new approaches to biosynthesis of biologicals from cell culture in space, and zero-g fermentation concepts; and upcoming flight opportunities and industrial application planning studies already underway. For individual titles, see N77-17678 through N77-17691.

N77-17678*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE AND LIFE SCIENCES **c16**
John A. Mason *In its* Bioprocessing in Space Jan. 1977 p 5-27 refs (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 22A

During the 1980's, some 200 Spacelab missions will be flown on space shuttle in earth-orbit. Within these 200 missions, it is planned that at least 20 will be dedicated to life sciences research, projects which are yet to be outlined by the life sciences community. Objectives of the Life Sciences Shuttle/Spacelab Payloads Program are presented. Also discussed are major space life sciences programs including space medicine and physiology, clinical medicine, life support technology, and a variety of space biology topics. The shuttle, spacelab, and other life sciences payload carriers are described. Concepts for carry-on experiment packages, mini-labs, shared and dedicated spacelabs, as well as common operational research equipment (CORE) are reviewed. Current NASA planning and development includes Spacelab Mission Simulations, an Announcement of Planning Opportunity for Life Sciences, and a forthcoming Announcement of Opportunity for Flight Experiments which will together assist in forging a Life Science Program in space. Author

N77-17679*# National Aeronautics and Space Administration, Washington, D.C.
NASA'S SPACE PROCESSING PROGRAM **c12**
James H. Bredt *In its* Bioprocessing in Space Jan. 1977 p 29-36 (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 22A

The NASA Space Processing Program was initiated to develop uses of space flight that will support research efforts and

manufacturing operations on the ground by processing materials in space. It is expected that the unique conditions that are available in space will provide a basis for a wide variety of economically beneficial services to science and industry in fields such as metallurgy, electronic materials, glass technology, fluid physics and chemistry, and in biological material preparation as well. Plans are described for developing payload equipment to implement materials processing experiments on the missions of the space transportation system (STS). This equipment is intended to support a diversified program of NASA-sponsored materials processing experiments by all classes of scientists, as well as pilot activities by non-NASA sponsors. Author

N77-17680*# Martin Marietta Corp., Denver, Colo.
BEHAVIOR OF FLUIDS IN A WEIGHTLESS ENVIRONMENT **c34**
Dale A. Fester, Ralph N. Eberhardt, and James R. Tegart *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 37-52 refs (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 20D

Fluid behavior in a low-g environment is controlled primarily by surface tension forces. Certain fluid and system characteristics determine the magnitude of these forces for both a free liquid surface and liquid in contact with a solid. These characteristics, including surface tension, wettability or contact angle, system geometry, and the relationships governing their interaction, are discussed. Various aspects of fluid behavior in a low-g environment are then presented. This includes the formation of static interface shapes, oscillation and rotation of drops, coalescence, the formation of foams, tendency for cavitation, and diffusion in liquids which were observed during the Skylab fluid mechanics science demonstrations. Liquid reorientation and capillary pumping to establish equilibrium configurations for various system geometries, observed during various free-fall (drop-tower) low-g tests, are also presented. Several passive low-g fluid storage and transfer systems are discussed. These systems use surface tension forces to control the liquid/vapor interface and provide gas-free liquid transfer and liquid-free vapor venting. Author

N77-17681*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE PROCESSING ON SKYLAB AND ASTP **c12**
R. S. Snyder *In its* Bioprocessing in Space Jan. 1977 p 53-66 refs (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 22A

The Skylab and Apollo Soyuz Test Project (ASTP) missions provided the opportunity the influence of micro-gravity on the processing of various materials. The results of physical and engineering experiments in metallurgy, fluids handling and crystal growth on two space missions are discussed. The majority of the experiments concern the solidification of alloys, semiconductors, and composite materials or basic liquid-liquid and solid-liquid interactions necessary to understand complex processing. Potential advantages of space processing to several materials disciplines are identified. Author

N77-17682*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THREE MODEL SPACE EXPERIMENTS ON CHEMICAL REACTIONS **c25**
Philomena Grodzka (Lockheed Missiles and Space Co., Huntsville, Ala.) and Barbara Facemire *In its* Bioprocessing in Space Jan. 1977 p 67-76 refs (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 07D

Three investigations conducted aboard Skylab IV and Apollo-Soyuz involved phenomena that are of interest to the biochemistry community. The formaldehyde clock reaction and the equilibrium shift reaction experiments conducted aboard Apollo Soyuz demonstrate the effect of low-g foams or air/liquid dispersions on reaction rate and chemical equilibrium. The electrodeposition reaction experiment conducted aboard Skylab IV demonstrate the effect of a low-g environment on an electrochemical displacement reaction. The implications of the three space experiments for various applications are considered. Author

N77-17683*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SURVEY OF CELL BIOLOGY EXPERIMENTS IN REDUCED GRAVITY
Gerald R. Taylor *In its* Bioprocessing in Space Jan. 1977 p 77-102 refs (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 06B

The effects of spaceflight on terrestrial cell systems are discussed. With some important exceptions, static cell systems carried aboard U.S.A. and U.S.S.R. space flights have failed to reveal space related anomalies. Some sophisticated devices which were developed for viewing directly, or continuously recording, the growth of cells, tissue cultures and eggs in flight, are described and the results summarized. The unique presence of high energy, multicharged (HZE) particles and full-range ultraviolet irradiation in space prompted evaluation of the response of single cells to these factors. Summary results and general conclusions are presented. Potential areas of research in future space flights are identified. Author

N77-17684*# Pennsylvania State Univ., University Park.
GRAVITY AND THE CELL: INTRACELLULAR STRUCTURES AND STOKES SEDIMENTATION
Paul Todd *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 103-116 refs (For primary document see N77-17677 08-51)
(Contract AT(30-1)-3834)
Avail: NTIS HC A10/MF A01 CSCL 06B

Plant and certain animal embryos appear to be responsive to the gravity vector during early stages of development. The convection of particle sedimentation as the basis for the sensing of gravity is investigated using the cells of wheat seedlings, amphibian embryos, and mammals. Exploration of the mammalian cell for sedimenting particles reveals that their existence is unlikely, especially in the presence of a network of microtubules and microfilaments considered to be responsible for intracellular organization. Destruction of these structures renders the cell susceptible to accelerations several times g. Large dense particles, such as chromosomes, nucleoli, and cytoplasmic organelles are acted upon by forces much larger than that due to gravity, and their positions in the cell appear to be insensitive to gravity. Author

N77-17685*# Veterans Administration, Washington, D.C.
BIOPROCESSING: PROSPECTS FOR SPACE ELECTROPHORESIS
Milan Bier *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 117-124 refs (For primary document see N77-17677 08-51)
(Contract NAS8-29566)
Avail: NTIS HC A01/MF A01 CSCL 06B

The basic principles of electrophoresis are reviewed in light of its past contributions to biology and medicine. The near-zero gravity environment of orbiting spacecraft may present some unique advantages for a variety of processes, by abolishing the major source of convection in fluids. As the ground-based development of electrophoresis was heavily influenced by the need to circumvent the effects of gravity, this process should be a prime candidate for space operation. Nevertheless, while a space facility for electrophoresis may overcome the limitations imposed by gravity, it will not necessarily overcome all problems inherent in electrophoresis. These are, mainly, electroosmosis and the dissipation of the heat generated by the electric field. The NASA program has already led to excellent coatings to prevent electroosmosis, while the need for heat dissipation will continue to impose limits on the actual size of equipment. It is also not excluded that, once the dominant force of gravity is eliminated, disturbances in fluid stability may originate from weaker forces, such as surface tension. Author

N77-17686*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTROPHORETIC SEPARATION OF HUMAN KIDNEY CELLS AT ZERO GRAVITY
Grant H. Barlow (Abbott Labs., North Chicago, Ill.), S. LaVera Lazer (Abbott Labs., North Chicago, Ill.), Annemarie Rueter (Abbott Labs., North Chicago, Ill.), and Robert Allen *In its* Bioprocessing in Space Jan. 1977 p 125-142 refs (For primary document

see N77-17677 08-51)
(Contract NAS8-30591)
Avail: NTIS HC A10/MF A01 CSCL 06B

Electrophoretic isolation of cells results in a loss of resolution power caused by the sedimentation of the cells in the media. The results of an experiment to extract urokinase from human embryos during the Apollo Soyuz mission are presented and discussed. A.H.

N77-17687*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
ELECTROPHORESIS FOR BIOLOGICAL PRODUCTION
Louis R. McCreight *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 143-158 (For primary document see N77-17677 08-51)
Avail: NTIS HC A01/MF A01 CSCL 06B

Preparative electrophoresis may provide a unique method for meeting ever more stringent purity requirements. Prolonged near zero gravity in space may permit the operation of preparative electrophoresis equipment with 100 times greater throughput than is currently available. Some experiments with influenza Virus Antigen, Erythropoietin and Antihemophaliac Factor, along with process and economic projections, are briefly reviewed. Author

N77-17688*# Fermentation Design, Inc., Bethlehem, Pa.
SOME QUESTIONS OF SPACE BIOENGINEERING
Laszlo K. Nyiri *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 159-180 refs (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 06B

Zero-gravity offers selective effect on growth and metabolic activity unicellular organisms as well as unique opportunities in purification of organic compounds. These make it possible to consider the biosynthesis and recovery of certain metabolites economically feasible in space. Design, construction and operation of systems for the above mentioned purposes requires interdisciplinary actions within the scope of a new discipline: space bioengineering. The problems and perspectives of this discipline particularly in the application of bioreactor-recovery systems in space to manufacture metabolites of high economic and scientific value. Special attention is paid to pivotal factors such as various mass transport phenomena, contamination control, automatic control of optimum environment and synchronization of the operation of the biological (biosynthesis) and the physiochemical (recovery-purification) systems. Author

N77-17689*# Bio Innovar, Inc., Storm Lake, Iowa.
INFLUENCE OF ZERO-G ON SINGLE-CELL SYSTEMS AND ZERO-G FERMENTER DESIGN CONCEPTS
Jerry V. Mayeux *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 181-190 refs (For primary document see N77-17677 08-51)
Avail: NTIS HC A10/MF A01 CSCL 06B

An analysis was made to identify potential gravity-sensitive mechanisms that may be present in the single-cell growth system. Natural convection (density gradients, induced sedimentation, and buoyancy) is important in microbial systems. The absence of natural convection in the space-flight environment could provide an opportunity for new approaches for developments in industrial fermentation and agriculture. Some of the potential influences of gravity (i.e., convection, sedimentation, etc.) on the cell were discussed to provide insight into what experimental areas may be pursued in future space-flight research programs. Author

N77-17690*# Boeing Co., Houston, Tex.
SPACE SOLAR POWER SYSTEMS **c44**
Curt Toliver *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 191-204 (For primary document see N77-17677 08-51)
Avail: NTIS HC A01/MF A01 CSCL 10A

Studies were done on the feasibility of placing a solar power station called POwersat, in space. A general description of the engineering features are given as well as a brief discussion of the economic considerations. L. L.

N77-17691*# General Electric Co., Philadelphia, Pa. Space Div.
BENEFICIAL USES OF SPACE **c85**
H. L. Bloom *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 205-218 refs (For primary document see N77-17677 08-51)
Avail: NTIS CSCL 05B

The study elicited over 100 ideas for Space Processing. Of the elicited ideas, more than 20% involved processing of biologicals, or related medical and life sciences applications. Among these were High Purity Separation of Isoenzymes, and Development of Biorhythms applications data. Program planning for four products is outlined. Experimentation and testing resulted in definition of nearly 70 series of tests in ground-based laboratories, sounding rockets, etc., and space shuttle. Development schedules established timing and interrelationships of decisions involved in carrying these products to the point of production. The potential profitability of the four products is determined. Resources needed to achieve full scale production included use of shuttle for transportation, for which cost apportionment model was developed. R and D resources for the four products totalled $46,000,000 with Isoenzymes requiring the smallest expenditure, $4,000,000. A computerized profitability model (INVEST) was used to determine the measures of profitability of each product. Results build confidence that there will be a payoff. Author

N77-17692*# Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECT OF AMBIENT TEMPERATURE ON METABOLISM AND HEART RATE IN RESTING ALBINO RATS
F. Bernet, M. Collache, and J. Denimal Washington NASA Feb. 1977 16 p refs Transl. into ENGLISH from Arch. Intern. de Phys. et de Biochom. (France), v. 83, 1975 p 633-645
(Contract NASw-2790)
(NASA-TT-F-17393) Avail: NTIS HC A02/MF A01 CSCL 06C

Heart rate and oxygen consumption were measured simultaneously in albino rats. These measurements were carried out in the resting animal at different temperatures between 18 and 33 C. Thermal neutrality was placed at 29 C. Results show that resting heart rate varies with metabolism. It shows the lowest values around the thermoneutrality point and increases rapidly as the environment cools. On the other hand, the non-linear relationship between metabolism and heart rate indicates that the increase in heart rate is not the only factor involved in increased oxygen consumption in the regulation of body temperature. Author

N77-17693*# Kanner (Leo) Associates, Redwood City, Calif.
HYGROPHORUS (LIMACIUM) HYPOTHEJUS FR. IN MYCORRHIZAL SYNTHESIS WITH PINE (PINUS SILVESTRIS L.) IN PURE CULTURES ON AGAR
R. Rachlewski and J. Pachlewska Washington NASA Feb. 1977 12 p refs Transl. into ENGLISH from Biul. Inst. Badawczego Lesnictwa (Warsaw), no. 5 427-432, 1974 p 205-212
(Contract NASw-2790)
(NASA-TT-F-17396) Avail: NTIS HC A02/MF A01 CSCL 06C

The biological test performed to determine the symbiotic characteristics of hygrophorus hypothejus permitted its classification among the mycorrhizal fungi of Pinus silvestris and also as an effective component in mycorrhizal associations with the pine during its juvenile stage of development. The progress of the mycorrhizal reaction with pine seedlings under conditions of synthesis in pure cultures on agar, characterized by a fast spread of the mycorrhizal infection in roots of seedlings and the formation of a large number of ectotrophic mycorrhizae, indicates a relatively high activity of H. hypothejus as a symbiont of pine seedlings. The results obtained from the mycorrhizal synthesis of pine with H. hypothejus, along with observations of this fungus in nature, suggest a high degree of symbiotic specialization of H. hypothejus for which pine is an indispensible partner. Author

N77-17694*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF THE VAPOR STERILIZATION PROCESS FOR NEW FILTERING MATERIALS
I. A. Kazakova, G. L. Motina, and V. A. Semenyuk Washington NASA Feb. 1977 11 p refs Transl. into ENGLISH from Khimiko-farmatsevticheskiy Zhurnal (USSR), v. 10, no. 10, 1976 p 103-107

(Contract NASw-2791)
(NASA-TT-F-17516) Avail: NTIS HC A02/MF A01 CSCL 06M

A study is made of a vapor sterilization process using live vapor to sterilize new filtering materials. The results give the required sterilization time for several new domestic filtering materials. Author

N77-17695*# Oregon State Univ., Corvallis.
ASSESSMENT OF THE IMPACT OF INCREASED SOLAR ULTRAVIOLET RADIATION UPON MARINE ECOSYSTEMS Annual Progress Report, 8 Oct. 1975 - 8 Oct. 1976
Henry VanDyke and Robert C. Worrest 8 Oct. 1976 40 p refs
(Contract NAS9-14860)
(NASA-CR-151201) Avail: NTIS HC A03/MF A01 CSCL 06C

Data was provided to assess the potential impact upon marine ecosystems if space shuttle operations contribute to a reduction of the stratospheric ozone layer. The potential for irreversible damage to the productivity, structure and/or functioning of a model estuarine ecosystem by increased UV-B radiation was established. The sensitivity of key community components (the primary producers) to increased UV-B radiation was delineated. Author.

N77-17696# Institut Franco-Allemand de Recherches, St. Louis (France).
EFFECT OF NUMBER AND RHYTHM OF SHOT NOISE (WEAPON SHOTS) ON THE HEARING OF GUINEA PIGS [INFLUENCE DU NOMBRE ET DU RYTHME D'EXPOSITIONS A DES BRUITS IMPULSIFS (BRUITS D'ARME) SUR L'APPAREIL AUDITIF DU COBAYE]
A. Dancer, R. Franke, G. Evrard, G. Parmentier, P. Drews, and E. Burde 28 Nov. 1975 35 p refs In FRENCH
(Contract DRME-74/735)
(ISL-R-133/75) Avail: NTIS HC A03/MF A01

The effect of shots produced in the open was investigated. Audiometry, based on recording of the cochlea potentials, led to the following results: the recovery time of auditory sensitivity is a function of 10 log t; the amplitude of the temporary threshold shift (TTS) is according to 20 log N, N being the number of shots; the amplitude of the TTS is maximum for 6 to 60 shots per minute. The validity of the existing standard curves (Coles and Pfander diagrams), as well as their applicability, are discussed. ESA

N77-17697# Bundesforschungsanstalt Fuer Fischerei, Hamburg (West Germany). Inst. fuer Seefischerei.
BIOLOGICAL PRODUCTIVITY IN THE MEXICAN PACIFIC COASTAL WATERS Interim Report
Siegfried Ehrich Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1976 20 p refs In GERMAN; ENGLISH summary
(Contract BMFT-MF-302)
(BMFT-FB-M-76-02) Avail: NTIS HC A02/MF A01; ZLDI, Munich, DM 4.20

Investigations were made in the coastal waters of the northeast Pacific between 14 and 46 deg N from October 10, 1974, to May 25, 1975, to determine cost effectiveness of trawler operations. At the same time the hydrography, plankton, fish stocks, and benthonic fauna of the region were studied in the interests of Mexican coastal fisheries. The activities at sea, the hydrographic conditions during the expedition, and the growth of the hake (merluccius productus) are reported. Some parameters to describe the stock of hake and the first results of the investigation on the rockfish (sebastes entomelas) are given. Author (ESA)

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-17698* + National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 162, JANUARY 1977
Jan. 1977 63 p
(NASA-SP-7011(162)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 189 reports, articles, and other documents introduced into the NASA scientific and technical information system in December 1976. Author

N77-17699*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASPIRIN/METIAMIDE COMPOSITION Patent Application
Patricia A. Brown, inventor (to NASA) (San Jose State Univ., Calif.) Filed 31 Jan. 1977 15 p Sponsored by NASA
(NASA-Case-ARC-11038-1; US-Patent-Appl-SN-764329) Avail: NTIS HC A02/MF A01 CSCL 06E

A pharmaceutical preparation is described which counters gastric distress caused by the ingestation of aspirin by the inclusion of metiamide in the analgesic formulation. NASA

N77-17700*# Houston Univ., Tex. Chemistry Dept.
DEVELOPMENT OF AUTOMATED ANALYTICAL CAPABILITY FOR THE EARLY DETECTION OF DIABETES MELLITUS Final Report
Albert Zlatkis May 1976 21 p refs
(Contract NAS9-14534)
(NASA-CR-151204) Avail: NTIS HC A02/MF A01 CSCL 06E

The total profile of volatile metabolites in urine of patients with diabetes mellitus was studied. Because of the drastic abnormalities in the metabolism of carbohydrates, lipids, and proteins connected with diabetes it was expected that apart from acetone further characteristic abnormalities occur in the profiles if volatile urinary metabolites in cases of diabetes mellitus. Quantitative and qualitative changes were found in these urines as compared to the urines of normal subjects. Author

N77-17701*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONTOUR DETECTOR AND DATA ACQUISITION SYSTEM FOR THE LEFT VENTRICULAR OUTLINE Patent Application
John H. C. Reiber, inventor (to NASA) Filed 16 Feb. 1977 45 p
(NASA-Case-ARC-10985-1; US-Patent-Appl-SN-769148) Avail: NTIS HC A03/MF A01 CSCL 06B

A real-time contour detector and data acquisition system for an angiographic apparatus was stipulated. A video scanner converted an x-ray image of a structure characterized by a change in brightness level compared with its surrounding into video format and displayed the X-ray image in recurring video fields. Author

N77-17702# Oak Ridge National Lab., Tenn.
FIFTY YEAR DOSE COMMITMENT TO VARIOUS ORGANS AND TISSUES FROM INHALATION OF Xe-133
S. R. Bernard and W. S. Snyder 1976 16 p refs Presented at Symp. on Radiopharmaceutical Dosimetry, Oak Ridge, Tenn., 26 Apr. 1976 Sponsored by ERDA
(CONF-760444-1) Avail: NTIS HC A02/MF A01

A metabolic model for a single inhalation of Xe133, together with the computer code in use at this Laboratory, was employed for estimating dose commitments to various organs and tissues in the adult human body. The code uses Monte Carlo data for photons and assumes complete absorption of the energy from the emitted electrons in organs and tissues. For bone, a model was used to estimate dose to red and yellow marrow and to endosteal cells of both trabecular and cortical bone. For a single inhalation of 1 mCi of Xe133 the 50 year dose to gonads was about 0.4 mrad. The dose to lungs from Xe133 dissolved in tissues is about the same, but the dose to the lungs from Xe133 in air spaces was about 1 mrad. Author (ERA)

N77-17703# Food and Drug Administration, Rockville, Md. Div. of Electronic Products.
DIAGNOSTIC ULTRASOUND: A REVIEW OF CLINICAL APPLICATIONS AND THE STATE OF THE ART OF COMMERCIAL AND EXPERIMENTAL SYSTEMS Final Technical Report
Stephen W. Smith Aug. 1976 92 p refs

(PB-258237/7; FDA/BRH-76/124;
DHEW/PUBL/FDA-76/8055) Avail: NTIS HC A05/MF A01
CSCL 06L

An overview of the current status of diagnostic ultrasound is given. Estimates are made of the size of the commercial diagnostic ultrasound market and the extent of clinical applications of the modality. Descriptions are presented of the current training opportunities and the professional societies involved in diagnostic ultrasound. GRA

N77-17704# Purdue Univ., Lafayette, Ind. Dept. of Electrical Engineering.
HIERARCHICAL INTELLIGENT CONTROL OF A PROSTHETIC ARM
G. N. Saridis and H. E. Stephanou Jul. 1976 227 p refs
(Grants NSF GK-36607; NSF ENG-74-17586)
(PB-258049/6; TR-EE-76-21) Avail: NTIS HC A11/MF A01
CSCL 06L

A hierarchical method combining analytical techniques from control theory and heuristic techniques from artificial intelligence is presented, and applied to the decentralized control of a prosthetic arm. The dynamic model of the arm is derived, and performance criteria are suggested for the kinematic and the dynamic evaluation of the system response. The principle of minimum interaction is used to decompose the prosthetic system into seven subsystems, one per mechanical degree of freedom. A 'suboptimal' control structure for nonlinear systems is proposed in conjunction with a performance adaptive self-organizing control algorithm. Syntactic pattern classification is used for the dynamic coordination of the subsystems. The syntax of the man-machine commands is also examined. GRA

N77-17705# Office of Radiation Programs, Washington, D.C. Environmental Analysis Div.
POTENTIAL RADIOLOGICAL IMPACT OF AIRBORNE RELEASES AND DIRECT GAMMA RADIATION TO INDIVIDUALS LIVING NEAR INACTIVE URANIUM MILL TAILINGS PILES
Jerry J. Swift, James M. Hardin, and Harry W. Calley Jan. 1976 53 p refs
(PB-258166/8; EPA-520/1-76-001) Avail: NTIS
HC A04/MF A01 CSCL 06R

The estimated potential annual dose from radioactive radon decay products to individuals in dwellings in the vicinity of an average inactive pile is approximately 8 rem to the tracheobronchial region of the lungs at about 50 meters from the pile, 0.3 rem at 1 kilometer, and 0.1 rem at about 2.2 kilometers. The corresponding doses to the pulmonary region of the lungs from airborne uranium thorium-230, and radium-226 are estimated to be about one-third as large, within 1 kilometer of the pile. Gamma exposure rates on the tailings are up to 1 mR/hr. Estimated exposure rates are in reasonable agreement with the limited data from field measurements. GRA

N77-17706# Army Aeromedical Research Lab., Fort Rucker, Ala.
SOME SPECIFIC EFFECTS OF HYPOBARIC HYPOXIA ON CELLULAR METABOLISM Final Report
Dennis A. Baeyens and Mary J. Meier Jan. 1976 18 p refs
(AD-A028928; USAARL-76-11) Avail: NTIS
HC A02/MF A01 CSCL 06/19

The lactate dehydrogenase (LDH) and succinate dehydrogenase (SDH) activity of mouse liver homogenates were examined after exposure to an equivalent altitude of 36,000 feet and compared to controls kept at ground level. After 6 and 12 hour incubation periods, the altitude exposed samples demonstrated a significantly higher LDH activity than controls. SDH activity remained unchanged from controls after 6 hours but was significantly lower than controls after 12 hour exposures to altitude. It is concluded that the changes in enzyme activity reflect a metabolic control mechanism to maintain adequate energy production during periods of exposure to hypobaric hypoxic stress. Author (GRA)

N77-17707# Emmanuel Coll., Boston, Mass.
ROLE OF NUCLEAR STARS IN THE LIGHT FLASHES OBSERVED ON SKYLAB 4 Scientific Report, 1 May 1975 - 30 Apr. 1976
Peter J. McNulty, Robert C. Filz, and Paul L. Rothwell Hanscom AFB, Mass. AFGL May 1976 18 p refs
(Contract F19628-73-C-0190; AF Proj. 8600)
(AD-A028733; AFGL-TR-76-0151; SR-3) Avail: NTIS
HC A02/MF A01 CSCL 06/18

The astronauts on Skylab 4 observed bursts of intense visual light-flash activity when their spacecraft passed through the portion of the earth's inner trapped radiation belt known as the South Atlantic Anomaly (SAA). Two experimental sessions were carried out on board Skylab which compare the flash rates with the measured flux of Z greater than or equal to 1 particles that would pass through the astronaut's eyes. It was concluded that the flash rates, which became as great as 20/minute, were anomalously high. The authors explored a number of alternative explanations for the anomalous flash rates that would be consistent with the accepted SAA flux values and the laboratory data on particle induced visual sensations and found that when one includes the effect of nuclear interactions in and near the retina which result in star formation (the emission of slow protons, neutrons, and alphas from the nucleus in an evaporation-like process) the apparent anomaly is removed. GRA

N77-17708# Edgewood Arsenal, Aberdeen Proving Ground, Md.
ADDED AIRWAY RESISTANCE AND ENDURANCE IN INTENSIVE EXERCISE Technical Report, Aug. - Dec. 1974
Fred W. Stemler and Francis N. Craig Jul. 1976 31 p refs
(DA Proj. 1W7-62710-AD-2501)
(AD-A028290; EB-TR-76040) Avail: NTIS HC A03/MF A01
CSCL 06/19

The effect of added airway resistance on endurance in running on a treadmill at 7 mph was tested in US Army male volunteers. Various combinations of inspiratory and expiratory resistance were provided by the following respiratory conditions: (A) standard M17A1 protective mask, (B) modified M17 mask, (C) peripheral M9 mask, (D) M9 mask less filter, (E) mouthpiece and nose-clip, and (F) bareheaded control. In a pilot study, conditions (A) and (F) were compared at two grades on the treadmill. The decrement in endurance due to condition (A) was greater at the lower grade. In series 1 and 2, the six conditions were compared at a single grade for each of nine men, including duplicate tests on three of the men. The results were consistent with the hypothesis that the decrement in endurance due to added airway resistance will be small at high and low work rates and will be maximal at some intermediate work rate. The small added airway resistance commonly found in equipment for making various respiratory measurements during exercise can cause a decrement in endurance in proportion to the size of the resistance. The results raised the question of whether, in the range of resistances of modern protective masks, the expiratory resistance is more critical than the inspiratory. GRA

N77-17709# DARCOM Intern Training Center, Texarkana, Tex.
PERFORMANCE OF A MAINTENANCE TASK IN A HIGH TEMPERATURE ENVIRONMENT Final Report
Terry Lee Durren Jun. 1976 43 p refs
(AD-A028798; DARCOM-ITC-02-08-76-024) Avail: NTIS
HC A03/MF A01 CSCL 06/19

The purpose of the research is to determine the effect that temperature has on the ability of an individual to perform a maintenance task. To demonstrate the effect of temperature, a statistical comparison of the mean task completion times of two treatment levels were examined. GRA

N77-17710# Advisory Group for Aerospace Research and Development, Paris (France).
RECENT EXPERIMENT/ADVANCES IN AVIATION PATHOLOGY
Dec. 1976 148 p refs Presented at the Aerospace Med. Panel Specialists' Meeting, Copenhagen, 5-9 Apr. 1976
(AGARD-CP-190; ISBN-92-835-0184-5) Avail: NTIS
HC A07/MF A01

Application of the methods and techniques of pathology to the investigation of aircraft accidents and aeromedical problems are discussed. Problems concerning local, national, and international law in determining jurisdiction and other (medicolegal) questions are cited along with special methods that aviation pathologist employ to aid in evaluation of the postmortem findings. These methods include developments in toxicologic

examination of tissues, roentgenographic evaluation analysis of specific injuries, and injury patterns and psychological factors were studied. For individual titles, see N77-17711 through N77-17729.

N77-17711# Armed Forces Inst. of Pathology, Washington, D.C.

DEVELOPMENT OF AIRCRAFT ACCIDENT INVESTIGATION PROGRAM AT THE ARMED FORCES INSTITUTE OF PATHOLOGY

William R. Cowan *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 3 p (For primary document see N77-17710 08-52)

Avail: NTIS HC A07/MF A01

The evolution of aircraft accident investigations in civilian and military aviation is presented. Three main principles governing medical support of fatal accidents: (1) environmental factors, (2) traumatic factors, (3) pre-existing disease processes are cited. Application of the tools of the forensic pathologist to the problem was initiated. Environmental factors such as carbon monoxide, and fuels were given top priority along with development of a procedure for lactic acid to detect hypoxia. Screening procedures for alcohol and drugs were also developed, along with procedures conducted on each specimen for carbon monoxide, ethyl alcohol, lactic acid and acid basic neutral drugs which may have altered the flight performance of an individual. B.B.

N77-17712# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

DEVELOPMENT OF AVIATION ACCIDENT PATHOLOGY IN THE FEDERAL REPUBLIC OF GERMANY

S. Krefft *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 5 p refs (For primary document see N77-17710 08-52)

Avail: NTIS HC A07/MF A01

Responsibilities and problems of aviation accident pathology are mentioned, and the importance of aviation accident pathology for the prevention of aircraft accidents and flying safety is discussed. Historical development of aviation accident pathology in Germany is presented in detail. B.B.

N77-17713# Centre de Recherches de Medecine Aeronautique, Paris (France).

THE PLACE AND ROLE OF MEDICAL SERVICES IN FLIGHT SAFETY STUDY OF THE ORGANIZATION AND MEANS USED IN THE FRENCH AIR FORCES [PLACE ET ROLE DES SERVICES MEDICAUX DANS LA SECURITE DES VOLS ETUDE SUR L'ORGANISATION ET LES MOYENS MIS EN OEUVRE DANS LES FORCES AERIENNES FRANCAISES]

P. M. Pingannaud *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 6 p In FRENCH (For primary document see N77-17710 08-52)

Avail: NTIS HC A07/MF A01

The importance of the human factor in the causes of accidents or air incidents is discussed along with the necessity for doctors to actively participate in flight safety. Organizational structure and regulatory disposition effective since 1975 are studied, and the functions of the medical profession in the investigation of the causes of accidents or air incidents are defined.

Transl. by B.B.

N77-17714# Royal Air Force, Halton (England). Div. of Aerospace Pathology.

AIRCRAFT-ACCIDENT AUTOPSIES: THE MEDICOLEGAL BACKGROUND

John L. Christie *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 13 p refs (For primary document see N77-17710 08-52)

Avail: NTIS HC A07/MF A01

Problems encountered by the aviation pathologist seeking to perform autopsies on the victims of aircraft accidents are evaluated. Authorities having jurisdiction in special cases to conduct investigations are mentioned along with the various interests of each group for conducting their investigation. B.B.

N77-17715# Italian Air Force Medical Service H. Q., Rome.

MEDICO-LEGAL PROBLEMS OF FLIGHT ACCIDENTS INVESTIGATION

Gaetano Rotondo *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 14 p refs (For primary document see N77-17710 08-52)

Avail: NTIS HC A07/MF A01

Necessity is premised of close collaboration between the specialist in forensic medicine and the flight surgeon, in flying accidents investigation. These accidents are surveyed in their different types, various traumatic mechanisms and possible correlations existing between physio-psychical conditions of flying personnel and genesis of single accidents. Different body lesions, sustained by victims of flight accidents, are deeply examined. They are divided into lesions pertaining to skeleton, internal organs and external teguments; and pathogenetic interpretation of each injuries is discussed. As conclusion, reconstruction of causes and ways of flight accident production is discussed. This can be possibly carried out through the examination of differential characteristics of various traumatic findings of the different types of accidents, considering kinedynamics of the single accident as well as the phase in which the injuries were sustained (precipitation, or explosive decompression with subsequent precipitation, or impact on the ground followed by an explosion or not, or explosion in flight followed by impact, or finally the terminal fire on board with or without inhalation of smoke or toxic gases). From this reconstruction useful elements can be obtained, for the prevention of flight accidents and dependent injuries. Author

N77-17716# Centro di Studi e Ricerche di Medicina Aeronautica e Spaziale, Rome (Italy).

LEGAL ASPECTS OF FLYING ACCIDENTS INVESTIGATION DISASTER VICTIMS IDENTIFICATION

G. Paolucci *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 4 p refs (For primary document see N77-17710 08-52)

Avail: NTIS HC A07/MF A01

Biological and non-biological systems for identification of victims in aviation disasters are discussed and described in detail. Some of the methods mentioned are the following: non-biological method; (1) direct identification, (2) identification by exclusion, (3) identification by examination of clothing and personal effects; biological methods; (1) definition of race, (2) determination of sex (3) estimation of age (4) determination of individual characteristics. B.B.

N77-17717# Armed Forces Inst. of Pathology, Washington, D.C.

PROCEDURES FOR IDENTIFICATION OF MASS DISASTER VICTIMS

Robert R. McMeekin *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 8 p refs (For primary document see N77-17710 08-52)

Avail: NTIS HC A07/MF A01

The problems of identification of mass disaster victims is discussed. Various techniques and identification methods are cited. B.B.

N77-17718# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

HISTOLOGY IN AIRCRAFT ACCIDENT RECONSTRUCTION

G. Apel *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 3 p refs (For primary document see N77-17710 08-52)

Avail: NTIS HC A07/MF A01

Histological methods of examining organs of fatally crashed pilots are discussed as a means of revealing diseases which may have limited the flying fitness of a pilot. Various cardiac complications, rare nervous diseases, and communicable diseases endemic only in certain parts of the globe are cited as some of the causes revealed through histological examination of pilot fatalities. B.B.

N77-17719# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

THE ASYMPTOMATIC SILENT MYOCARDIAL INFARCTION AND ITS SIGNIFICANCE AS POSSIBLE AIRCRAFT ACCIDENT CAUSE

G. Beckmann and W. Eisenmenger *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 3 p refs

(For primary document see N77-17710 08-52)
Avail: NTIS HC A05/MF A01

Myocardial infarction in pilots is discussed as one of the numerous possible causes of aircraft disasters. Two cases are cited in which pilots 33 and 43 years old complained about retrosternal pains of short duration (1 minute) respectively nausea as encountered in hypoxia incidents. Since there was no subsequent pain, there was no cause for and examination by a physican so that the pilots continued their flying duty. After an interval of 10 months respectively 1 month the ECG taken during the periodic flying fitness examination revealed the symptoms of a myocardial infarction suffered by the respective pilots.
Author

N77-17720# Armed Forces Inst. of Pathology, Washington, D.C.
CORRELATION OF OCCURRENCE OF AIRCRAFT ACCIDENTS WITH BIORHYTHMIC CRITICALITY AND CYCLE PHASE
John H. Wolcott, Robert R. McMeekin, Robert E. Burgin (Natl. Transportation Safety Board), and Robert E. Vanowitch (FAA, Washington, D. C.) *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 14 p refs (For primary document see N77-17710 08-52)
Avail: NTIS HC A07/MF A01

The occurrence of aircraft accidents on various biorhythmic phases of cycles was studied. Aircraft accident data were obtained from the National Transportation Safety Board for general civil aviation and from the U. S. Army Agency for Aviation Safety for military accidents. The accidents were divided into two groups, pilot and nonpilot involved cases, using the causal factors given by the respective accident boards. No correlation was found between the occurrence of aircraft accidents and either the critical period, the negative phase, or the peak days of the negative phase of the biorhythmic cycles. Data were evaluated by chi-square analysis when considering all three cycles or the physical and emotional cycles alone, and all were studied with a critical period of 24 or 48 hours' duration. Author

N77-17721# Armed Forces Inst. of Pathology, Washington, D.C.
THE INTERPERTATION OF PRECENTAGE SATURATION OF CARBON MONOXIDE IN AIRCRAFT-ACCIDENT FATALITIES WITH THERMAL INJURY
Joseph M. Ballo and Abel M. Dominguez *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 8 p refs (For primary document see N77-17710 08-52)
Avail: NTIS HC A07/MF A01

Victims of aircraft-accident fatalities suffering severe thermal trauma (as defined by second- or third-degree burns and/or percent saturation of carboxyhemoglobin values of 10 or greater) were evaluated. Of 518 cases accessioned from 1968 through 1974, 83 had either sublethal or no physical trauma. The mechanism of death in such cases is (1) glottal spasm, bronchospasm, or acute edema of the upper respiratory passage, (2) cardiovascular collapse secondary to vagal inhibition, (3) acute thermal hyperkalemia potentiated by high levels of circulating catecholamines, (4) complete combustion of flammable material by on-board oxygen supplies, producing an intense fire without the production of CO, or (5) poisoning by other toxic products of combustion. Author

N77-17722# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
TOXICOLOGICAL ASPECTS IN THE INVESTIGATION OF FLIGHT ACCIDENTS
G. Powitz *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 4 p refs (For primary document see N77-17710 08-52)
Avail: NTIS HC A07/MF A01

The working methods of the German flight toxicology working group were examined. Positive alcohol results required a determination of the water content and a test of possible putrefactive processes. The various procedures for blood alcohol determination were compared and it was found that the enzyme method furnished high values differing from others. Gas-chromatography identified some endogenous substances and putrefactive components respectively, some cases of joint occurrence are mentioned. The disadvantage of the photometric determination of carbon monoxide in burned corpses was illustrated. Extraction methods required for chromatographic separations of biological material were discussed and some disadvantages compared. Author

N77-17723# Royal Air Force Inst. of Pathology and Tropical Medicine, Aylesbury (England).
RECENT AGRICULTURAL AIRCRAFT ACCIDENTS IN THE UNITED KINGDOM
D. G. Wooten *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 7 p (For primary document see N77-17710 08-52)
Avail: NTIS HC A07/MF A01

Agricultural aviation accidents were analyzed for cause, geographical distribution, and frequency. The probability of an accident occurring increased indirectly with age of the pilot and directly with his experience. Pilot error was the direct cause of the majority of accidents. Improved education and legislation would help to reduce the exposure to toxic chemicals. Author

N77-17724# Armed Forces Inst. of Pathology, Washington, D.C. Div. of Aerospace Pathology.
ACCIDENT RECONSTRUCTION FROM ANALYSIS OF INJURIES
Joseph M. Ballo and Robert R. McMeekin *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 11 p refs (For primary document see N77-17710 08-52)
Avail: NTIS HC A07/MF A01

From an ongoing study of over 500 fatally injured crewmembers of U.S. military aircraft every year and an analytically oriented research program in which injury patterns were verified by computerized simulation techniques, estimates were prepared of injury correlated with both the magnitude and the direction of the applied decelerative forces. When an accurate tabulation of postmortem injuries was correlated with measurements of the path of the aircraft after it struck the ground, the dynamics of impact were deduced. This process was invaluable for accidents that occurred without witnesses or survivors and in which crash damage to flight instruments or the absence of flight-data recorders made calculation of impact kinematics difficult. Skeletal injuries, particularly vertebral compression fractures, lacerations and contusions of viscera, aortic tears and lacerations, and cutaneous contusions caused by compression of harnesses and seat belts, were important factors in determining the direction and magnitude of the deceleration vector. Author

N77-17725# Army Aeromedical Research Lab., Fort Rucker, Ala. Bioengineering and Life Support Equipment Div.
HEAD INJURY PATHOLOGY AND ITS CLINICAL, SAFETY AND ADMINISTRATIVE SIGNIFICANCE
Stanley C. Knapp and Thomas M. Erhardt *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 9 p refs (For primary document see N77-17710 08-52)
Avail: NTIS HC A07/MF A01

A review of head trauma in war, vehicular accidents, sports, and aviation demonstrated that while the head constitutes roughly 9 percent of the body's weight, surface area and volume, it is implicated in 7 out of 10 body injuries. Head trauma causes an unacceptable 1 in 4 deaths and for motorcycling it causes a staggering 1 out of every 2 deaths. It was proposed that examination of head trauma, its costs and the effectiveness of provided protection must apply the analytic tools of epidemiology not only to the injury but to the equipment as well. Prevention requires anticipatory action, based on the knowledge of protective performance history, in order to make the onset or further occurrence of injury unlikely. Author

N77-17726# Naval Aerospace Medical Research Lab., New Orleans, La.
NEUROPATHOLOGY AND CAUSE OF DEATH IN U.S. NAVAL AIRCRAFT ACCIDENTS
Channing L. Ewing and Friedrich Unterharnscheidt *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 6 p refs (For primary document see N77-17710 08-52)
Avail: NTIS HC A07/MF A01

A frequent cause of death in naval aviation was hypothesized as drowning, associated with acceleration concussion perhaps

due to neck stretch. Aircraft accident fatality data for the U. S. Navy were presented as a measure of the population at risk and recent data from the literature which might explain the causative mechanism of acceleration concussion are presented. Recommendations for improved standard autopsy protocols for aircraft fatalities were presented. Author

N77-17727# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
CLARIFICATION OF A FATAL HELICOPTER GROUND ACCIDENT THROUGH FORENSIC MEDICAL METHODS
G. Apel *in* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 3 p refs (For primary document see N77-17710 08-52)
Avail: NTIS HC A07/MF A01

Based on the investigation of a fatal helicopter ground accident, which was clarified through forensic medical methods, problems of accident prevention were pointed out, especially the conspicuity of rotating propellers, tail rotors and safety markings. The dangers encountered as a result of vigilance and concentration disturbances in personnel caused by stress of noise, workload, and distraction were discussed. Safety measures required were also presented. Author

N77-17728# Royal Air Force Inst. of Pathology and Tropical Medicine, Aylesbury (England). Dept. of Aviation Pathology and Forensic Medicine.
FATAL HELICOPTER ACCIDENTS IN THE UNITED KINGDOM
A. J. C. Balfour *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 8 p (For primary document see N77-17710 08-52)
Avail: NTIS HC A07/MF A01

There were 27 fatal helicopter crashes investigated in the United Kingdom in the years 1956 to 1975; there were 52 deaths and 15 survivors. Of the crashes 25 percent were survivable and produced 15 percent of the casualties and 73 percent of the survivors. There were 44 men killed in the non-survivable accidents and 4 escaped. In the 6 survivable crashes 8 men died; 5 drowned, one died from fire, one died from traumatic asphyxia, and one submarined out of his safety harness. The casualties emphasized the need for further improvements in training and in helicopter crash worthiness, and for the best early rescue facilities that can be provided. Author

N77-17729# Brooke Army Medical Center, Fort Sam Houston, Tex.
ROENTGENOGRAPHIC EVALUATION IN FATAL AIRCRAFT ACCIDENTS
Richard A. Mosby and Robert R. McMeekin *In* AGARD Recent Experience/Advan. in Aviation Pathol. Dec. 1976 7 p refs (For primary document see N77-17710 08-52)
Avail: NTIS HC A07/MF A01

The roentgenogram was evaluated as having great value in the investigation of fatal aircraft accidents. The entire spectrum of the accident was evaluated with this modality magnifying and enhancing the information available. Calibration of the roentgenogram for use in the investigation of a fatal aircraft accident provided even more useful and factual data. Author

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N77-17730# Civil Aeromedical Inst., Oklahoma City, Okla.
AN INVESTIGATION OF TIME-SHARING ABILITY AS A FACTOR IN COMPLEX PERFORMANCE
Alan E. Jennings and W. Dean Chiles May 1976 16 p refs (AD-A031881/6; FAA-AM-76-1) Avail: NTIS HC A02/MF A01 CSCL 05/5

Thirty-nine men were tested on a total of six tasks; performance was measured on each task presented individually and on two complex tasks made up of three-task subsets. The tasks measured monitoring, arithmetic, pattern-discrimination, tracking, and problem-solving performance. Factor analyses were performed on the resultant data to determine if there would emerge a time-sharing ability, defined as a reliable source of variance associated with complex performance but independent of simple-task performance of the constituent tasks. High loadings were found for two different monitoring tasks for complex performance but negligible loadings for these tasks for simple performance. Separate independent factors were found for the two monitoring tasks when they were performed under simple-task conditions. The monitoring measures appear to possess properties that would be expected of measures of a time-sharing ability. The findings suggest that a suitable measure of time-sharing ability would be of value in the selection and screening of candidates for complex jobs. Author

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-17731# National Swedish Road and Traffic Research Inst., Linkoeping.
EFFECTS OF SMALL DOSES OF ALCOHOL ON DRIVER PERFORMANCE IN EMERGENCY TRAFFIC SITUATIONS
Hans Laurell 1975 27 p refs Sponsored by Natl. Swed. Road Safety Office
(VTI-68-A) Avail: NTIS HC A03/MF A01

The effects on driver performance of Blood Alcohol Concentrations (BAC) below 50 mg % were studied in two contexts: 1. in a critical automobile driving situation involving emergency braking and evasive maneuvers and 2. in a surprise situation that followed the first one and featured the sudden appearance of a man-shaped obstacle blocking the roadway. The results indicate the detrimental effects of alcohol at a total BAC average of 42 mg %. In the braking and maneuvering task, drivers under the influence of alcohol hit significantly more pylons and took significantly longer distances to stop. There was also a strong tendency for alcohol to impair performance in the surprise situation. Under the influence of alcohol five drivers out of ten collided with the obstacle; this was the case for only one driver out of ten in the control (non-alcohol) condition. Author (ESA)

N77-17732# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
DEVELOPMENT OF A STANDARDIZED MEASUREMENT AND EDP EVALUATION PROGRAM FOR ERGONOMIC DATA AND FLIGHT DATA. PART 1: TECHNICAL PRINCIPLES. PART 2: EVALUATION COMPUTER PROGRAM [ENTWICKLUNG EINES STANDARDISIERTEN MESS- UND EDV-AUSWERTUNGSPROGRAMMES FUER ERGONOMISCHE DATEN UND FLUGDATEN. TEIL 1: TECHNISCHE GRUNDLAGEN ZUR ERMITTLUNG UND AUFZEICHNUNG ERGONOMISCHER MESSDATEN. TEIL 2: BESCHREIBUNG DER AUSWERTUNGS-RECHENPROGRAMME]
U. Miller and H. Fickenwirth 26 May 1976 197 p refs In GERMAN
(Contract BMFT-T/RF-36/RF-360/31107)
(MBB-UFE-1231) Avail: NTIS HC A09/MF A01

The sensors and recorders are described which are necessary for the measurement of biomedical data in order to determine physiological stress in pilots. A portable cassette tape recorder was developed especially for flights without telemetry, e.g., MRCA terrain following missions. The development of an evaluation program for standardization of computer processing of biomedical data and flight parameters is reported. ESA

N77-17733# Naval Postgraduate School, Monterey, Calif.
THE SIGNIFICANT PARAMETERS AFFECTING THE MODELLING OF TARGET ACQUISITION OF GROUND COMBAT TARGETS FROM TACTICAL HELICOPTERS M.S. Thesis
Basil Grahame Baskerville Jun. 1976 68 p refs
(AD-A028853) Avail: NTIS HC A04/MF A01 CSCL 15/7

The acquisition of ground targets in combat from tactical helicopters, employing low-level flying techniques, is a complex process. The author examines the air-to-ground target acquisition process and investigates the parameters affecting this process. The tactical environment of helicopters is outlined and those parameters deemed significant and/or peculiar to this environment are identified. Current mathematical models of air-to-ground target acquisition are reviewed. Those which are considered relevant to this particular problem are described. The author concludes that there are no validated models for predicting target acquisition from tactical helicopters. Author (GRA)

N77-17734# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
INTERNATIONAL ANTHROPOMETRIC VARIABILITY AND ITS EFFECTS ON AIRCRAFT COCKPIT DESIGN
Kenneth W. Kennedy Jul. 1976 22 p refs
(AF Proj. 7184)
(AD-A027801; AMRL-TR-72-45) Avail: NTIS HC A02/MF A01 CSCL 01/3

This paper is concerned with high performance, single seat, military aircraft cockpits and the problems encountered in accommodating them to the anthropometric requirements of foreign military users. These problems often are very difficult. Design changes invariably required to cope with any significant anthropometric differences are fraught with seemingly insurmountable economic and engineering problems. Still, malacommodation in aircraft not only produces a condition in which the product is inconvenient to operate, but one in which the user's safety and the basic mission of the aircraft can be compromised. GRA

N77-17735# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
SUMMARY REPORT OF AMRL REMOTELY PILOTED VEHICLE (RPV) SYSTEM SIMULATION STUDY 4 RESULTS
Niles M. Aume, Robert G. Mills, and Aldo A. Gillio Jun. 1976 43 p
(AD-A028877; AMRL-TR-76-55) Avail: NTIS HC A03/MF A01 CSCL 01/3

The AMRL RPV System Simulation and Research Program was initiated in response to requirements for support of the design of the man-machine/environment interface of AF RPV systems. The major objectives of the AMRL RPV System Simulation and Research Program are as follows: (1) Perform RPV system design evaluation studies, i.e., evaluate alternative design configurations, assumptions, operating procedures, etc.; (2) assess RPV system effectiveness, i.e. evaluate the expected effectiveness of a given system configuration such as its overall probability of achieving a target, etc.; (3) provide man-machine/environment interface engineering data, i.e. recommend displays etc.; (4) test bed new technology, e.g. evaluate effectiveness of contractor designed consoles, video bandwidth compression techniques, etc. The results of the fourth simulation study are reported herein. This study included automatic RPV heading correction and position report smoothing functions in the simulation. The study employed scenarios requiring a limited number of support mission RPVs, via reprogramming, to provide coverage for a set of Strike RPVs (or manned vehicles). The study evaluates RPV system performance under the simultaneous effects of RPV Automatic Heading Correction Cross Track Threshold, Total Number of RPVs Under System Control, Ratio of Strike Set to Support Vehicle Set, and Display (Window) Sizes or Scales. GRA

N77-17736# School of Aerospace Medicine, Brooks AFB, Tex.
HUMAN COMPATIBILITY TESTING OF A PRESSURE-BREATHING, MASK, MBU-12/P Final Report, Apr. - Dec. 1975
Julian P. Cooke May 1976 16 p refs
(AF Proj. 7164)
(AD-A027823; SAM-TR-76-11) Avail: NTIS HC A02/MF A01 CSCL 06/11

Subject preference for the MBU-12/P mask over the MBU-5/P was revealed by results from more than 48 altitude-chamber tests with each of these oxygen pressure-breathing masks. According to subject evaluation, the assets of the MBU-12/P mask include: more comfort; better ability to Valsalva; more freedom of movement of the head; less redness and marking of the face; greater peripheral vision; and, at altitude, a tighter seal against loss of oxygen. The responses of both masks at low and high temperatures were similar. Subjective evaluation of communication revealed no apparent difference between the two types of mask. Moderate improvement was measured in tendency of the MBU-12/P mask to hold to the face and not leak during exposure to increased gravity fields of 3, 5, and 7 Gz. Author (GRA)

N77-17737# School of Aerospace Medicine, Brooks AFB, Tex.
LASER-PROTECTION EYEWEAR: AN EVALUATION PROCEDURE Interim Report, Feb. 1974 - Dec. 1975
William J. Fodor May 1976 16 p refs
(AF Proj. 6301)
(AD-A027826; SAM-TR-76-19) Avail: NTIS HC A02/MF A01 CSCL 06/18

A program for evaluating laser-protection eyewear has been developed. This program includes a battery of optical tests before and after 'weathering' the test item under standard conditions. Unique aspects of the evaluation are a high-energy bleaching test and high-optical-density tests. Guidelines for interpreting the test results are discussed. Author (GRA)

N77-17738# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFECTS OF HIGH G ON PILOT MUSCLE STRENGTH AVAILABLE FOR AIRCRAFT CONTROL OPERATION
K. H. E. Kroemer Jul. 1976 4 p refs Repr. from Preprints of 1973 Annual Scientific Meeting, Aerospace Medical Association, Las Vegas, Nevada, 7-10 May 1973 p 255-256
(AF Proj. 7184)
(AD-A027802; AMRL-TR-73-22) Avail: NTIS HC A02/MF A01 CSCL 06/19

High accelerations, especially in the Z-direction, prevail during certain flight phases of airplanes or spacecraft. The resulting 'G-forces' can severely hamper the crew's ability to move body segments and/or to operate controls as indicated in abundancy by (often anecdotal) case reports. Grether's overview of the literature, reveals surprisingly little systematic research regarding the capability to exert muscular strength for control operation under high acceleration. This lack of information does not only pertain to the operation of seldomly used or new controls (like for ejection initiation during extreme G-conditions), but applies even to such common controls as stick, throttle, or sidearm controller. GRA

N77-17739# Manned Systems Sciences, Inc., Northridge, Calif.
HUMAN FACTORS RESEARCH AND THE DEVELOPMENT OF A MANNED SYSTEMS APPLICATIONS SCIENCE: THE SYSTEMS SAMPLING PROBLEM AND A SOLUTION
Dorothy L. Finley and Frederick A. Muckler Jul. 1976 50 p refs
(Contract N00014-74-C-0324; NR Proj. 274-244; NR Proj. 364-090)
(AD-A029417) Avail: NTIS HC A03/MF A01 CSCL 05/5

Human factors specialists, or 'systems psychologists', have extensively used the systems approach to define and solve man-man and man-machine problems. As of yet, however, there has been no attempt to develop a body of knowledge on the dimensionalization of manned systems. That is, a body of knowledge regarding what dimensions define a system, as opposed to such components as an individual operator or piece of equipment. For example, what classes of system dimensions are there and what role do they play in addressing what problems. For the operator component, for example, there are skill dimensions vs. ability dimensions; whether one works with one or the other or both classes depends on what the question is. It is suggested that a body of knowledge on manned systems dimensions would be useful as the stepping stone which facilitates the solution of new problems and as a basis for organizing human performance data in a way applicable to systems design problems. This report points out: (1) The need to begin identifying and incorporating systems design and operation parameters into research programs (in addition to, for example, visual display and operator performance dimensions); (2) The nature of the systems research and dimensionalization problem, and (3) A model to support the systems dimensionalization process. This process is defined as

essentially one of taxonomization for the purpose of developing the measure set. Author (GRA)

N77-17740# Sierra Engineering Co., Sierra Madre, Calif.
ANTHROPOMETRIC TEST DUMMY, MODEL 825-50 OPERATION AND SERVICE MANUAL Final Report, 1 Dec. 1972 - 28 Feb. 1975
J. L. Roshala and Leonard E. Popp Aug. 1976 100 p
(Contract DOT-HS-254-3-568)
(PB-258384/7; DOT-HS-801-972-2; TR-825-900-2) Avail: NTIS HC A05/MF A01 CSCL 13F

A test dummy was developed which NHTSA used for compliance tests with appropriate Federal motor vehicle safety standards in the evaluation of protection systems for vehicle occupants during real and simulated impact conditions. A corresponding test dummy data package was generated which is made available to any source interested in manufacturing, checking, comparing with other dummy configurations and otherwise verifying the accuracy and precision of the various details. GRA

N77-17741# North Carolina Univ., Chapel Hill. Highway Safety Research Center.
A STATISTICAL ANALYSIS OF SEAT BELT EFFECTIVENESS IN 1973-1975 MODEL CARS INVOLVED IN TOWAWAY CRASHES. VOLUME 1 Final Report, 1 Jul. 1975 - 31 May 1976
Donald W. Reinfurt, Claudio Z. Silva, and Andrew F. Seila Sep. 1976 165 p refs
(Contract DOT-HS-5-01255)
(PB-258542/0; DOT-HS-802-035-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 13F

The data were collected in five different geographic regions. Weighted sample size available for the analysis was 15,818 occupants for which there is complete information on belt usage, injury level, age, crash configuration, vehicle weight, and damage severity. A sensitivity analysis was carried out to determine the effect on the estimates of including various subsets of the control variables. The estimates were reworked using direct injury costs derived largely from insurance data. GRA

N77-17742# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
AN APPARATUS FOR EVALUATING PILOT PREFERENCE OF ELECTRONIC DISPLAY INFORMATION AND FORMATS
William A. Breitmaier 28 Jul. 1976 19 p refs
(AD-A028723; NADC-76195-40) Avail: NTIS HC A02/MF A01 CSCL 05/8

An apparatus was developed for use in evaluation of electronic displays. The apparatus consists of four random access slide projectors, remote controls for the projectors, and a static cockpit mock-up with nonfunctional controls. The apparatus was used in a preference survey of the Engine Management Display portion of the Advanced Integrated Display System (AIDS). The apparatus provides a simple, inexpensive, flexible, and timely means for evaluating potential users' preference of display information and formats. GRA

N77-17743# Payne, Inc., Annapolis, Md.
THE HEAT PULSE ASSOCIATED WITH ESCAPE FROM AN AIRCRAFT AT SUPERSONIC SPEED Final Report, 18 Nov. 1975 - 31 Mar. 1976
Peter R. Payne Wright-Patterson AFB, Ohio AMRL Jun. 1976 55 p refs
(Contract F33615-75-C-5096; AF Proj. 7231)
(AD-A028988; WP-148-6; AMRL-TR-76-2) Avail: NTIS HC A04/MF A01 CSCL 01/2

The air temperature environment in supersonic escape is defined conservatively, and the heat pulse associated with deceleration after escape is calculated. This is compared with data on the human body's tolerance to short period heat pulses, using data in the literature and data derived from new experiments to show that thermal injury is not a problem when the escapee is wearing a full pressure suit. Exposed skin may experience pain above a Mach number of four (M = 4), however, and blister above M = 5. Author

N77-17744# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
SPEECH COMMUNICATION CAPABILITY AND HEARING PROTECTION OF USAF INFLIGHT HEADGEAR DEVICES
Henry C. Sommer Jun. 1976 16 p refs
(AF Proj. 7231)
(AD-A029007; AMRL-TR-75-67) Avail: NTIS HC A02/MF A01 CSCL 01/2

In this investigation, both speech intelligibility and hearing protection were determined for various USAF inflight communication headgear devices. Speech intelligibility was measured with talker to listener relationships of quiet to quiet, quiet to noise, noise to quiet and noise to noise. The noise used for both talking and listening was set to 110 dB in each octave band from 63 Hz to 2 kHz and 105 dB in the 4 kHz and 8 kHz octave bands. Speech materials were recorded using both boom (kiss-to-talk) and oxygen mask microphones. The results reveal that many noise exposure conditions now specified as satisfactory for military aircraft may be in the range where adequate speech communication cannot be maintained. GRA

N77-17745# Air Force Human Resources Lab., Brooks AFB, Tex.
SITUATIONAL EMERGENCY TRAINING: F-15 EMERGENCY PROCEDURES TRAINING PROGRAM. PHASE 1 Interim Report, Jul. 1975 - Jan. 1976
Jack A. Thorpe, Elizabeth L. Martin, Bernell J. Edwards, and Edward E. Eddowes Jun. 1976 23 p
(AF Proj. 1123)
(AD-A028483; AFHRL-TR-76-47(1)) Avail: NTIS HC A02/MF A01 CSCL 01/2

This report evaluates the current emergency procedures training program used for the F-15 and compares it to Boldface emergency procedures training programs. The report documents the current F-15 program--a non-Boldface program. Traditional emergency procedures, common to other USAF weapons systems featuring Boldface procedures which must be committed to memory, do not exist for the F-15. Only three rules, applicable in all emergency/abnormal situations, are specified for F-15 operations: maintain aircraft control, analyze the situation and take the proper action, and land as soon as practicable. This report evaluates an optimum emergency procedures training program for the F-15 and provides the basis for comparing the F-15 training program with Boldface training programs. The strengths and weaknesses of both approaches are noted, and five conclusions are derived from this comparative analysis. GRA

N77-17746# Naval Air Engineering Center, Lakehurst, N.J. Engineering Dept. (SI)
PRIMARY FLIGHT CONTROL WORK STATION IMPROVEMENT STUDY, PHASE A Final Report, Jul. 1975 - Jun. 1976
Tak Po Sit and Neal G. Senholzi 23 Aug. 1976 45 p refs
(AD-A029650; NAEC-ENG-7916) Avail: NTIS HC A03/MF A01 CSCL 17/2

This study shows that practical changes may be made by which the efficiency and effectiveness of the Pri-Fly Control Work Station can be improved. These recommended changes are grouped according to their impact in the areas of environment, communication, equipment arrangement and visibility.
Author (GRA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N77-17747*# Kanner (Leo) Associates, Redwood City, Calif.
POSSIBLE UNIQUENESS OF RATIONAL LIFE IN THE UNIVERSE
I. S. Shklovskiy Washington NASA Feb. 1977 27 p refs Transl. into ENGLISH from Vopr. Filosofii (USSR), no. 9, 1976 p 80-93
(Contract NASw-2790)
(NASA-TT-F-17404) Avail: NTIS HC A03/MF A01 CSCL 06F

Arguments for and against the uniqueness, or virtual

uniqueness of rational life in the universe are weighed. Contrary to popular belief, over most of the past 15 centuries the multiplicity of rational worlds was widely accepted in the West. The likelihood that the earth is alone in the universe is reached from an examination of the implication that supercivilizations transforming some of the Universe have not been detected. Author

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N77-17748# Battelle Pacific Northwest Labs., Richland, Wash.
ASSEMBLING MICROPROCESSOR SOFTWARE WITH MINICOMPUTERS
T. A. Seim Mar. 1976 13 p Presented at Symp. on Trends and Appl.: Micro and Mini Systems, Gaithersburg, Md., 27 May 1976
(Contract E(45-1)-1830)
(BNWL-SA-5701; Conf-760507-2) Avail: NTIS HC A02/MF A01

The combination of a general purpose computer and its supporting software into a virtual machine with special-purpose capabilities was analyzed. A virtual computing system for developing microprocessor software was realized by extending the capabilities of existing systems, rather than building a completely new system. One technique useful in extending computer system capabilities was the definition of micro- and minicomputer instruction sets with macros. The methodology of macro implementation was described for a DEC PDP-11, and example macro sets for the Intel 8080 and Motorola 6800 were included. ERA

N77-17749# California Univ., Livermore. Lawrence Livermore Lab.
INTRODUCTION TO THE THEORY OF MACHINES AND LANGUAGES
P. P. Weidhaas 1 Apr. 1976 123 p refs Sponsored by ERDA
(UCID-17045) Avail: NTIS HC A06/MF A01

An elementary guided tour through some basic concepts of modern computer science are introduced. Various models of computing machines and formal languages were studied in detail. Discussions center around problems such as, the scope of problems that can or cannot be solved by computers. ERA

N77-17750# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
STUDY OF A CORE STORE FOR USE IN AN IMAGE PHOTON COUNTING SYSTEM FOR AN ASTRONOMICAL INSTRUMENT ON LST Final Report
M. Gaernter, F. Gliem, F. Pittermann, M. Schlenther, and F. Strauss Jul. 1976 102 p refs
(Contract ESTEC-2434/75-PP)
(ESA-CR(P)-856) Avail: NTIS HC A06/MF A01

The integration of an image received from a faint object by means of a large space telescope is accomplished by digital counting in an address memory. Various candidate core memories are reviewed and the choice of a word-organized memory with conventional addition is recommended. The implementation with a proven ferrite core memory is preferred to that with a MOS memory. The design with the required memory is discussed in detail. It is shown that all requirements are met, except that of weight, which is exceeded by 25%. ESA

N77-17751# Texas Univ., Austin. Dept. of Mathematics.
FITTING SURFACES TO SCATTERED DATA Interim Report
Larry L. Schumaker 1976 67 p refs
(Grant AF-AFOSR-2598-74; AF Proj. 9749)
(AD-A027870; AFOSR-76-0872TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

This paper is a survey of methods for fitting a surface to a set of data scattered throughout a plane region. The methods surveyed include interpolation, smoothing, least-squares, and a variety of other direct and approximation methods. The fitting functions include polynomials, rationals, splines, and others. Numerical methods are emphasized, and contouring is also discussed. GRA

N77-17752# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
MICROPROCESSOR CONTROLLER/DEBUG SYSTEM
William F. Baxter 28 May 1976 60 p refs
(AD-A029010; RG-76-61) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes a system which provides a method for debugging the hardware and software of a microprocessor developed for use as a digital autopilot. GRA

N77-17753# IBM Federal Systems Div., Owego, N.Y.
PROGRAM DOCUMENTATION FOR THE RPV MISSION CONTROL CENTER SYSTEM SIMULATION PROGRAM
D. L. Wartluft May 1976 104 p
(Contract F33615-75-C-5152; AF Proj. 7184)
(AD-A028879; AMMRC-TR-76-47; AMRL-HESS-76-6) Avail: NTIS HC A06/MF A01 CSCL 09/2

The Remotely Piloted Vehicle Mission Control System (RMCS) Simulation Program is a real-time, interactive, graphics program which simulates a hypothetical mission control center. It provides a means for analyzing the effects of numerous variables on the operator performance of a five-man team whose task is to control up to 35 Remotely Piloted Vehicles (RPVs) through the enroute, terminal, and return phases of a simulated strike mission. The enroute and return phases are performed by four operators seated at IBM 2250 Display Units. The terminal phase is simulated by a single operator who controls a remotely located terrain table which is interfaced to his control station through an IBM 1827 Data Control Unit. GRA

N77-17754# Aerospace Corp., El Segundo, Calif.
THE AUTOCORRELATION FUNCTION OF THE OUTPUT OF AN N-LEVEL QUANTIZER WITH AN ANGLE-MODULATED INPUT SIGNAL Interim Report
Lloyd M. Nirenberg 23 Sep. 1976 31 p refs
(Contract F04701-75-C-0076)
(AD-A030282; TR-0076(6901)-6; SAMSO-TR-76-203) Avail: NTIS HC A03/MF A01 CSCL 09/5

A formula is given for the autocorrelation function of the output of an arbitrary, time-invariant nonlinearity with an arbitrary angle-modulated input. The general result is specialized to the case of an odd-symmetric, but otherwise arbitrary, quantizer. It is shown that to evaluate the output autocorrelation the second-order characteristic function (SOCF) of the modulation is required. Using previously derived SOCFs for a constant, a Gaussian random process, and a generalized random telegraph wave (RTW), the output autocorrelation is given explicitly. Using the SOCF for a binary phase-shift keyed (BPSK) signal, derived here for the first time, the output autocorrelation with BPSK modulation is also presented. Finally, the autocorrelation functions of the modulated input processes are given by reducing the quantizer to a linearity, with the results for the generalized RTW and BPSK modulations being new. GRA

N77-17755# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
CONSYS: A COLLECTION OF FORTRAN SUBROUTINES TO PRODUCE CONTOUR MAPS OF DATA SURFACES

DEFINED ON RECTANGULAR GRIDS
Gerald N. Cederquist Jul. 1976 54 p refs
(Contract N00014-75-C-0174)
(AD-A027871; CEL-TM-112; Rept-013514-2-M) Avail: NTIS HC A04/MF A01 CSCL 08/2

The CONSYS routines produce coordinate pairs for the straight-line vectors forming a contour map. The routines operate on user supplied samples of the x, y, and z coordinates that specify the data surface to be contoured. To reduce processing time, the routines assume that the data samples are available on a rectangular grid; surfaces represented by randomly scattered samples cannot be directly contoured by CONSYS. The routines are device--independent in the sense that at execution time the user must supply the names of subroutines that CONSYS can call to dispose of contour line coordinate pairs. CONSYS works entirely in the user's coordinate system, and the user is responsible for any scaling and translation necessary to map the coordinate pairs into a viewable area on the plotting device or graphics terminal being used. Author (GRA)

N77-17269*# Perkin-Elmer Corp., Danbury, Conn. Optical Technology Div.
COMPUTER-AIDED ANALYSIS OF CCD LINEAR IMAGE SENSORS
Steven S. Prince *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 57-62 (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 09B

N77-17305# Osaka Univ. (Japan). Dept. of Electronic Engineering.
VARIABLE SAMPLING RATE CODER
Keiichi Murakami, Keihachiro Tachibana (Nagasaki Coll. of Naval Architecture), Hiroshi Fujishita (TOA Electric Co., Ltd., Kobe), and Koichi Omura *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 499-508 refs (For primary document see N77-17291 08-31)
(Rept-1323) Avail: NTIS HC A10/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-17756*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A SURVEY OF COMPILER DEVELOPMENT AIDS
B. P. Buckles (Science Applications, Inc., La Jolla, Calif.), B. C. Hodges, and P. Hsia (Ala. Univ., Hunstville) Washington Feb. 1977 98 p refs
(NASA-TM-X-3490; M-200) Avail: NTIS HC A05/MF A01 CSCL 09B

A theoretical background was established for the compilation process by dividing it into five phases and explaining the concepts and algorithms that underpin each. The five selected phases were lexical analysis, syntax analysis, semantic analysis, optimization, and code generation. Graph theoretical optimization techniques were presented, and approaches to code generation were described for both one-pass and multipass compilation environments. Following the initial tutorial sections, more than 20 tools that were developed to aid in the process of writing compilers were surveyed. Eight of the more recent compiler development aids were selected for special attention - SIMCMP/STAGE2, LANG-PAK, COGENT, XPL, AED, CWIC, LIS, and JOCIT. The impact of compiler development aids were assessed some of their shortcomings and some of the areas of research currently in progress were inspected. Author

N77-17757*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
DATA COMPRESSION FOR SATELLITE IMAGES Final Report
Po Hsiin Chen and Paul A. Wintz Dec. 1976 148 p refs
(Grant NsG-5010; Contract F30602-75-C-0150)
(NASA-CR-149655; TR-EE-77-9) Avail: NTIS HC A07/MF A01 CSCL 05B

An efficient data compression system is presented for satellite pictures and two grey level pictures derived from satellite pictures. The compression techniques take advantages of the correlation between adjacent picture elements. Several source coding methods are investigated. Double delta coding is presented and shown to be the most efficient. Both predictive differential quantizing technique and double delta coding can be significantly improved by applying a background skipping technique. An extension code is constructed. This code requires very little storage space and operates efficiently. Simulation results are presented for various coding schemes and source codes. Author

N77-17758# Los Alamos Scientific Lab., N.Mex.
THREE-DIMENSIONAL POTENTIAL FIELD CALCULATIONS
W. A. Cook Apr. 1976 17 p refs
(Contract W-7405-eng-36)
(LA-6315-MS) Avail: NTIS HC A02/MF A01

An approach is described that may be used to solve three-dimensional potential problems using three separate codes. ERA

N77-17759# Oak Ridge National Lab., Tenn.
EIGENSYSTEM COMPUTATION FOR SKEW-SYMMETRIC MATRICES AND A CLASS OF SYMMETRIC MATRICES
R. C. Ward and L. J. Gray May 1976 32 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-9) Avail: NTIS HC A03/MF A01

An algorithm is given for computing the eigenvalues and (optionally) the eigenvectors of either a skew symmetric matrix or a symmetric tridiagonal matrix with constant diagonal. The algorithm uses only orthogonal similarity transformations, and is believed to be the most efficient algorithm available for computing all the eigenvalues or the complete eigensystem. ERA

N77-17760# California Univ., Livermore. Lawrence Livermore Lab.
FUNPACK USER'S GUIDE
F. N. Fritsch Mar. 1976 23 p refs
(Contract W-7405-eng-48)
(UCID-30135) Avail: NTIS HC A02/MF A01

A collection of certified software is presented for the evaluation of special functions. Routines are available for the computation of exponential integrals, complete elliptic integrals of the first and second kind, and Dawson's integral. ERA

N77-17761# California Univ., Livermore. Lawrence Livermore Lab.
GOOF: OCTOPUS ERROR MESSAGES, ORDER, ORDERLIB, AND FLOE
Gail Whitten 3 Mar. 1976 35 p refs
(Contract W-7405-eng-48)
(UCID-30131) Avail: NTIS HC A03/MF A01

The error messages returned by three parts of the Livermore timesharing system were compiled: the ORDER batch-processor, the ORDERLIB subroutine library, and the FLOE operating system. ERA

N77-17762# California Univ., Livermore. Lawrence Livermore Lab.
USER'S GUIDE TO SLOPE, A SIMULATOR OF THE SCOPE OPERATING SYSTEM EXECUTABLE UNDER THE LIVERMORE TIMESHARING SYSTEM ON CDC 7600 COMPUTERS AT LLL
William E. Johnston 19 Feb. 1976 27 p refs
(Contract W-7405-eng-48)
(UCID-30115-Rev-1) Avail: NTIS HC A03/MF A01

SLOPE is an implementation of CDC's SCOPE/KRONOS operating system for the CDC 7600 computer. Available as an executable program on the Livermore timesharing system (LTSS), SLOPE enables users to run SCOPE jobs brought from outside and to set up SCOPE-like jobs that are run under SCOPE elsewhere. This guide introduces users to the SLOPE system and to the SLOPE reference manual, which is available online on LTSS. Instructions on how to convert files and tapes from one system to the other are cited. Listings of input and output files, and of teletypewriter interactions, are included. ERA

N77-17763# Los Alamos Scientific Lab., N.Mex.
LASIP-3, A GENERALIZED PROCESSOR FOR STANDARD INTERFACE FILES
G. E. Bosler, R. D. ODell, and W. M. Resnik Mar. 1976 97 p refs
(Contract W-7405-eng-36)
(LA-6280-MS) Avail: NTIS HC A05/MF A01

This processor performs two distinct tasks, namely, transforming free-field format and providing for printing and punching data in the binary files. Techniques are described for easily separating the processor into two modules, viz., one for creating the binary files and one for printing the files. The two modules can be separated into free-standing codes or they can be incorporated into other codes. ERA

N77-17764# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY USERS MANUAL FOR BBC
W. G. Sutcliffe, S. I. Warshaw, and R. F. Litterst 10 May 1976 30 p refs
(Contract W-7405-eng-48)
(UCID-17124) Avail: NTIS HC A03/MF A01

BBC is a two-dimensional, multifluid Eulerian hydro code based on the code KRAKEN and some later development. Either cylindrical or slab problems can be run. The grid is bounded by a rectangular band of empty boundary zones. The interfaces between the regular and boundary zones are selected to be either rigid or vacuum interfaces. The setup for BBC problems is described in the KEG manual. Author (ERA)

N77-17765# Battelle Pacific Northwest Labs., Richland, Wash.
SOLUTION WEIGHTING FOR THE SAND-2 MONTE CARLO CODE
C. A. Oster, W. N. McElroy (Hanford Eng. Develop. Lab.), R. L. Simons (Hanford Eng. Develop. Lab.), E. P. Lippincott (Hanford Eng. Develop. Lab.), and G. R. Odette (California Univ., Santa Barbara) Apr. 1976 18 p refs Presented at Seminar on Radiation Energy Spectra Unfolding, Oak Ridge, Tenn., 12 Apr. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5736; Conf-760437-3) Avail: NTIS HC A02/MF A01

Background information on the SAND II algorithm is provided during discussion of recent extensions of the SAND II error analysis Monte Carlo code to include solution weighting based on input uncertainty data. This procedure permits input data having smaller uncertainties to have a greater influence on the solution spectrum than do the data having larger uncertainties. The results of an in-depth study to find a practical procedure are presented. ERA

N77-17766# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
AN ALGORITHM FOR SOLVING OPTIMAL CONTROL PROBLEMS VIA THE SEQUENTIAL CONJUGATE GRADIENT-RESTORATION METHOD
A. V. Levy (Univ. Nacl. Autonoma de Mexico) and K. H. Well 10 Aug. 1976 38 p refs
(DLR-IB-552-76/6) Avail: NTIS HC A03/MF A01

The underlying theory of the computer algorithm presented is briefly reviewed, and the program, together with a flow chart, is described. Two numerical examples, concerning hovercraft optimal turning and reentry vehicle optimal steering, are solved. The results obtained demonstrate the characteristics of the algorithm. Author (ESA)

N77-17767# National Bureau of Standards, Washington, D.C. Systems and Software Div.
APPRAISAL OF FEDERAL GOVERNMENT COBOL STANDARDS AND SOFTWARE MANAGEMENT: SURVEY RESULTS Final Report
Donald R. Deutsch Jun. 1976 75 p refs
(PB-258371/4; NBSIR-76-1100) Avail: NTIS HC A04/MF A01 CSCL 09B

Software management tools and practices and the standardization of the COBOL programming language were subjects of a survey conducted at 190 domestic Federal installations having hardware capable of supporting a modern COBOL compiler. Tabular summarizations of all responses for each survey question are given. Gross statistics and frequency distributions are presented on a question-by-question basis. No interquestion relationships are analyzed. The appendices include a comprehensive discussion of the sampling methodology and survey mechanics and a reproduction of the survey instrument with cross references to response tabulations appearing in the report. GRA

N77-17768# Naval Postgraduate School, Monterey, Calif.
AN EVALUATION AND COMPARISON OF SEVERAL SINGLE VARIABLE SEARCH METHODS M.S. Thesis
Daniel Brian Wick Jun. 1976 73 p refs
(AD-A028443) Avail: NTIS HC A04/MF A01 CSCL 12/2

This study compares three single variable search methods - Golden Section, cubic interpolation and quadratic interpolation. The SUMT nonlinear program was used for the comparison. The OPT subroutine which performs the single variable search in SUMT currently uses the Golden Section method. Two different OPT subroutines were written which implemented cubic interpolation and quadratic interpolation. Seven test problems which contained 9-100 variables and 2-20 constraints were used. The comparison was made on computation time per single variable search for the three methods and the number of function evaluations per single variable search for the Golden Section and quadratic interpolation methods. A single variable search by Lasdon, Fox and Ratner and one by Fletcher and McCann were also discussed. The results showed that the quadratic interpolation was slightly faster than the other two methods and required fewer function evaluations per single variable search than the Golden Section method. GRA

N77-17769# Washington State Univ., Pullman. Dept. of Computer Science
THE UPDATE STEP IN LINEAR PROGRAMMING USING MODIFIED GIVENS TRANSFORMATIONS Technical Report, 1975 - 1976
Richard J. Hanson and John A. Wisniewski Apr. 1976 18 p refs
(Contract N00014-68-A-0410-0004; NR Proj. 044-457)
(AD-A028366; WSU-CS-76-029) Avail: NTIS HC A02/MF A01 CSCL 12/1

An efficient and numerically stable method is presented for the problem of updating an orthogonal decomposition of a matrix of column (or row) vectors. The fundamental idea is to add a column (or row) analogous to adding an additional row of data in a linear least squares problem: A column (or row) is dropped by a formal scaling with the imaginary unit followed by least squares addition of the column (or row). The elimination process for the procedure is successive application of the Givens transformation in modified (more efficient) form. Some suggested computational tests for determining signs of various controlling parameters in the revised simplex algorithm are also given. Author (GRA)

N77-17770# Wisconsin Univ., Madison. Mathematics Research Center.
LINEAR PROGRAMMING ALGORITHMS FOR THE CHEBYSHEV SOLUTION TO A SYSTEM OF CONSISTENT LINEAR EQUATIONS
Uri Ascher Mar. 1976 19 p refs
(Contract DAAG29-75-C-0024; Grant NSF [illegible]PS-72-00381-A01)
(AD-A027888; MRC-TSR-1617) Avail: NTIS HC A02/MF A01 CSCL 12/2

Efficient linear programming algorithms for the solution of a set of overdetermined linear equations in (l sub 1) norm are employed in order to obtain a minimum (l sub infinity) solution to a set of consistent linear equations. In addition, the solution is proved to be of a particular form in case that the set of equations is a Chebyshev system. GRA

N77-17771# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
AN ACCESS CONTROL FACILITY FOR PROGRAMMING LANGUAGES Interim Report
Anita K. Jones and Barbara H. Liskov May 1976 41 p refs

(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A027845; AFOSR-76-0886TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

Controlled sharing of information is needed and desirable for many applications. Access control mechanisms exist in operating systems to provide such controlled sharing. However, programming languages currently do not support such a facility. This paper argues that to enhance software reliability programming languages should support controlled sharing of information; the paper illustrates how such an access control facility could be incorporated in a programming language. The mechanism described is suitable for incorporation in object-oriented languages which permit the definition of abstract data types; it is defined in such a way as to enable compile time checking of access control. GRA

N77-17772# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.

ALGORITHMIC AND ARCHITECTURAL ISSUES RELATED TO VECTOR PROCESSORS

D. A. Calahan 1976 15 p refs
(Grant AF-AFOSR-2812-75; AF Proj. 9749)
(AD-A027776; AFOSR-76-0870TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper considers the increasing impact of computer architecture on algorithm development. After describing the mathematical modeling of parallel/pipeline (vector) processors, the models are used to develop complexity expressions for vectorized solution of certain well-known algorithms. These expressions in turn reveal the overhead cost of the vectorization of sequential algorithms. Software and functional characteristics of current vector processors are compared. GRA

N77-17773# Naval Postgraduate School, Monterey, Calif.

SOFTWARE ENGINEERING: TOOLS OF THE PROFESSION M.S. Thesis

Arrena Sue Williams Sep. 1976 93 p refs
(AD-A028868) Avail: NTIS HC A05/MF A01 CSCL 09/2

Software engineering is presented as a new branch of the engineering disciplines. The tools and techniques of the profession are examined in an attempt to resolve definitional ambiguities and describe the concepts or attitudes generally associated with three specific programming methodologies. Language properties supportive of the methodologies are investigated. The professional tools and language characteristics are evaluated in terms of their effect on DOD software. GRA

N77-17774# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.

AN ADAPTIVE TRANSFORM CODING ALGORITHM Interim Report

Andrew G. Tescher and Richard V. Cox 12 Apr. 1976 10 p refs
(Contract F04701-75-C-0076)
(AD-A028840; TR-0076(6519-01)-1; SAMSO-TR-76-183) Avail: NTIS HC A02/MF A01 CSCL 09/4

An adaptive transform coding algorithm based on a recursive procedure in the transform domain has been developed. Both the quantization parameters and bit assignment are dynamically determined and thus are closely matched to the actual image structure. Overhead requirements are minimal. GRA

N77-17775# Computer Sciences Corp., Falls Church, Va.

COMPUTER PROGRAM DESCRIPTION: PWRDEN - A PROGRAM FOR THE EVALUATION OF POWER DENSITIES IN THE NEAR FIELD OF ANTENNA APERTURES

William B. Munson Sep. 1976 30 p
(Contract DCA100-73-C-0008; DCA Proj. 04188)
(AD-A030463) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report describes the mathematical analysis and the computer program for the prediction of power densities in the vicinity of antenna apertures. Author (GRA)

N77-17776# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

SEMANTIC INTERPRETATION REVISITED

Bonnie L. Nash-Webber Jul. 1976 49 p refs Presented at the Coling-76, Ottawa, 28 Jun. - 2 Jul. 1976
(Contract N00014-75-C-0533)
(AD-A028993; BBN-3335; AI-48) Avail: NTIS HC A03/MF A01 CSCL 05/7

After providing brief overview of the BBN LUNAR system, the author discusses two of its deficiencies: (1) the simple 'enumerate and test' processing of quantified expressions in its meaning representation language; and (2) its inadequate treatment of anaphora. The author makes a rough classification of anaphoric expressions as groundwork towards formulating a general computational treatment of the phenomenon. In this classification, she establishes a distinction between (1) denotational anaphora references to previously mentioned objects, sets, events, states, etc., and (2) descriptional anaphora -- references to previous descriptions. The report concludes with an initial sketch of both a formal meaning representation language and some procedures seen needed for manipulating sentences of the language, which may provide a handle on some aspects of anaphor resolution. GRA

N77-17777# Wisconsin Univ., Madison. Mathematics Research Center.

KOLMOGOROV'S LAW OF THE ITERATED LOGARITHM FOR BANACH SPACE VALUED RANDOM VARIABLES Summary Report

J. Kuelbs Jun. 1976 38 p refs
(Contract DAAG29-75-C-0024)
(AD-A029907; MRC-TSR-1632) Avail: NTIS HC A03/MF A01 CSCL 12/1

Kolmogorov's version of the law of the iterated logarithm (LIL) for random variables taking values in a real separable Banach space is established. This result has several corollaries dealing with the LIL for independent, identically distributed (i.i.d.) sequences and, in particular, extends some of the recent work of G. Pisier. GRA

N77-17778# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.

EFFICIENT NETWORK SOLUTIONS TO PARALLEL PROCESSOR SCHEDULING PROBLEMS: A SURVEY

John J. Bartholdi, III, Louis Martin-Vega (Puerto Rico Univ., Mayaguez, Puerto Rico), and H. Donald Ratliff Jun. 1976 53 p refs
(Grant DAHC04-75-C-0150; Contracts DAHC04-75-G-150; N00014-75-C-0783; DA Proj. 200-61102-A-14D)
(AD-A030023; RR-76-16) Avail: NTIS HC A04/MF A01 CSCL 12/1

Parallel processor scheduling problems are special in that they assume no ordering among machines. Most of the scheduling problems for which there exist efficient algorithms are included in this class. In many of the well-solved problems of this area, network formulations are explicit or at least possible. We survey parallel processor scheduling from the thematic viewpoint of efficient network solutions. Author (GRA)

N77-17296# Osaka Univ. (Japan). Dept. of Electronic Engineering.

AN ALGORITHM FOR GENERATING ALL THE PATHS BETWEEN TWO VERTICES IN A DIGRAPH AND ITS APPLICATION

Tran Dinh Am, Shunji Tsukiyama, Isao Shirakawa, and Hiroshi Ozaki *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 411-418 refs (For primary document see N77-17291 08-31)
(Rept-1313) Avail: NTIS HC A10/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N77-17779# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.

PETRI NET AS A MODELING TOOL

Pamela B. Thomas 1976 10 p refs Presented at 14th Ann. Conf. of Southeast Regional Assoc., for Computing Machinery, Birmingham, Ala., 22 Apr. 1976
(K/CSD/INF-76/3; Conf-760430-1) Avail: NTIS HC A02/MF A01

An extended Petri net model is introduced, and its greater flexibility for coordination modeling is demonstrated. The cigarette smokers' problem is modeled with a Petri net, and a producer-consumer problem is solved with the extended Petri net. The net is briefly evaluated with mention of results of an experimental high-level language simulation of the extended Petri net. ERA

N77-17780# Argonne National Lab., Ill.
ARGONNE INTRA-LABORATORY NETWORK
William P. Lidinsky 1976 13 p Presented at the Workshop on Distributed Data Management, Berkeley, Calif., 25 May 1976
(Contract W-31-109-eng-38)
(CONF-760550-3) Avail: NTIS HC A02/MF A01

The Applied Mathematics Division of Argonne National Lab. is developing the Argonne Intra-Laboratory Network. This network is planned to provide a high-speed transmission capability between nodes throughout the Laboratory. The network is being implemented as a packet transmission, distributed control system capable of supporting random topology. Primary emphasis will be on task communication between different hosts. Host task to network protocols will be kept simple. Links of the network will consist of dedicated wire, radio, and infrared carrier facilities. The first state is an experimental link called SWIFTE for overall experimentation and testing. GRA

N77-17781# Defense Systems Management School, Fort Belvoir, Va.
MANAGEMENT INFORMATION SYSTEMS FOR THE US ARMY SATELLITE COMMUNICATIONS AGENCY
Edwin L. Cross May 1976 44 p refs
(AD-A029273) Avail: NTIS HC A03/MF A01 CSCL 05/1

This report describes the potential benefits which would accrue from a central computerized Management Information System (MIS) installed at the U.S. Army Satellite Communications Agency, and how such a system might be developed. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N77-17782# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Regelungssysteme.
OPTIMAL INPUT DESIGN FOR SYSTEM IDENTIFICATION Ph.D. Thesis - Tech. Hochschule Darmstadt, West Ger.
Gerd Schulz 26 Jul. 1976 142 p refs In GERMAN; ENGLISH summary
(DLR-FB-76-40) Avail: NTIS HC A07/MF A01; DFVLR, Cologne, DM 56.10

A new procedure of input design for systems with measurement and process noise is presented based on the design of optimal inputs for parameters identification of discrete systems with measurement noise only. Thereby the Cramer-Rao inequality as a measure for the minimal variance of the estimation error of the parameter is extended, such that additionally system noise can be considered. Monte-Carlo simulations confirm the associated decrease of the estimation-error variance of the parameter. The procedure is extended to the design for continuous systems and a solution for arbitrarily long identification intervals is given. Author (ESA)

N77-17783# Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.
ON STATISTICAL AND STRUCTURAL FEATURE EXTRACTION
C. H. Chen 19 May 1976 10 p refs
(Grant AF-AFOSR-2951-76; AF Proj. 9769)
(AD-A028405; EE-76-1; AFOSR-76-0877TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of extracting effective features has played a major role in pattern recognition studies. Most effort, however, has been made on the selection of statistical (or mathematical) features. Examples of these features are the orthogonal transforms of vector measurements. Although such features may not have physical meaning, they are usually effective and computable. The main drawback with the statistical feature extraction is that it is difficult to take contextual dependence into consideration. In many patterns such as the imagery data, there is a close interrelation among various parts of a pattern. Such interrelation representing the structural properties must be taken into account to achieve the best recognition performance. In this paper we consider the structural feature extraction in a more general sense by taking into account the relationships among parts of a pattern, and the physical, perceptual, psychological, and/or physiological factors which may be translated from description to mathematical expressions suitable for automatic recognition. The paper reviews the problems in both statistical and structural feature extraction, compares the feasible approaches and examines the statistical and structural mixed model for feature extraction. Author (GRA)

N77-17784# Rice Univ., Houston, Tex. Dept. of Electrical Engineering.
ON A CLASS OF MINIMUM ENERGY CONTROLS RELATED TO SPLINE FUNCTIONS Interim Report
A. N. Netravali and R. J. P. DeFigueiredo Jul. 1975 14 p refs
(Grants AF-AFOSR-2777-75; NSF ENG-75-17955; AF Proj. 9769)
(AD-A027846; EE-TR-7513; AFOSR-76-0866TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of determining a minimum energy control for a dynamically interconnected set of p single-input single out-put finite-dimensional linear time-varying dynamical systems, for which the outputs are constrained to assume prescribed values at different points in time is considered. It is shown that the solution (optimal controller) is obtained by performing a linear operation on an appropriate vector-valued generalized interpolating spline. Author (GRA)

N77-17785# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Electrical and Systems Engineering.
EDGE DETECTION IN NOISY IMAGES USING RECURSIVE DIGITAL FILTERING
J. W. Modestino Jul. 1976 36 p refs
(Contract N00014-75-C-0281; NR Proj. 375-971)
(AD-A028994; TR-76-1) Avail: NTIS HC A03/MF A01 CSCL 09/4

The problem of detecting edges in noisy digitized images is considered. A stochastic model of edge structure is proposed and the edge detection problem formulated as one of least mean-square spatial filtering. The resulting filtering structures are implemented as two-dimensional recursive digital filters. Computer experiments with this class of edge detectors will be described. The results indicate substantial advantages over conventional edge detectors in the presence of noise. Applications to real-world imagery data are discussed. Author (GRA)

N77-17786# Naval Postgraduate School, Monterey, Calif.
LIMIT CYCLES IN A DAMPED AND BIASED RELAY SYSTEM
Arthur L. Schoenstadt Aug. 1976 48 p refs
(AD-A029635; NPS-53ZH76081) Avail: NTIS HC A03/MF A01 CSCL 17/2

This paper considers the necessary and sufficient conditions for limit cycle solutions in a damped and biased relay system. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-17787# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
AN ITERATIVE FINITE ELEMENT SCHEME FOR BIFURCATION ANALYSIS OF SEMI-LINEAR ELLIPTIC EQUATIONS
Fumio Kikuchi Jun. 1976 33 p refs
(ISAS-542) Avail: NTIS HC A03/MF A01

An iteration process is employed to treat nonlinearity of the problems and to avoid numerical instability in the vicinity of bifurcation points. Convergence analysis of the iterative process and error analysis of the finite element solutions are performed by the use of the principle of contraction mappings and some established results of the finite element method. The proposed approach is also available for the analysis of initial imperfection. Numerical solutions are illustrated to see the effectiveness of the proposed method. Author

N77-17788# Los Alamos Scientific Lab., N.Mex.
METHODS OF SIGNIFICANCE ARITHMETIC
N. Metropolis 1976 19 p refs Presented at Conf. on the State of the Art in Numerical Analysis, York Univ., England, 12 Apr. 1976
(Contract W-7405-eng-36)
(LA-UR-76-661; Conf-760428-1) Avail: NTIS HC A02/MF A01

There were two applications of the methods of significance arithmetic given. These were a simple nonlinear partial differential equation and matrix inversion. Author (ERA)

N77-17789# California Univ., Livermore. Lawrence Livermore Lab.
ELEMENTARY INTRODUCTION TO FINITE DIFFERENCE EQUATIONS
J. W. White 3 May 1976 35 p refs
(Contract W-7405-eng-48)
(UCRL-52067) Avail: NTIS HC A03/MF A01

An elementary description is given of the basic vocabulary and concepts associated with finite difference modeling. The material discussed is biased toward the types of large computer programs used at the Lawrence Livermore Laboratory. Particular attention is focused on truncation error and how it can be affected by zoning patterns. The principle of convergence is discussed, and convergence as a tool for improving calculational accuracy and efficiency is emphasized. ERA

N77-17790# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
GENERALIZED MEAN SQUARED ERROR PROPERTIES OF REGRESSION ESTIMATORS
R. F. Gunst and R. L. Mason (Southwest Res. Inst., San Antonio, Tex.) 1976 10 p refs
(Contract N00014-75-C-0439; Grant AF-AFOSR-2871-75; AF Proj. 9769)
(AD-A027772; AFOSR-76-0836TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Theobald (1974) compares Ordinary Least Squares and Ridge Regression estimators of regression parameters using a generalized mean squared error criterion. This paper presents the generalized mean squared error of a Principal Components Regression estimator and comparisons are made with each of the above estimators. In general the choice of which estimator to use depends on the magnitude and the orientation of the unknown parameter vector. GRA

N77-17791# Naval Postgraduate School, Monterey, Calif.
ON RANDOM BINARY TREES Technical Report, Jun. 1975 - Jun. 1976
Gerald G. Brown and Bruno O. Shubert Jun. 1976 49 p refs Sponsored by ONR
(AD-A028454; NPS-55BW76061) Avail: NTIS HC A03/MF A01 CSCL 12/1

Binary trees are examined combinatorially with the view of providing information useful in analyzing algorithms based on this widely used storage structure. Exact and asymptotic results are given for equally likely trees and those grown by binary insertion tree sorts applied to random strings of key symbols. An appendix is provided with tabulations of results. GRA

N77-17792# New York Univ., N.Y. Applied Science Div.
A CYCLIC-ORDER PROPERTY OF BODIES WITH THREE-FACE VERTICES Interim Report
R. Shapira and H. Freeman Aug. 1975 16 p refs
(Grant AF-AFOSR-2755-75; AF Proj. 9769)
(AD-A028394; CRL-42; AFOSR-76-0876TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A cyclic-order property is defined for three-dimensional bodies with vertices formed by three faces. The property is useful in resolving ambiguities caused by the extraction of imperfect line data from photographs of such bodies. The property augments the grammatical rules that govern the possibility or impossibility of the existence of three-dimensional bodies corresponding to particular two-dimensional line-structure projections. Author (GRA)

N77-17793# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ON SOME GENERALIZED FARLIE-GUMBEL-MORGENSTERN DISTRIBUTIONS. 2: REGRESSION, CORRELATION AND FURTHER GENERALIZATIONS
N. L. Johnson and S. Kote (Temple Univ.) Jul. 1976 16 p refs
(Contract DAHC04-74-C-0030)
(AD-A028422; Mimeo-Ser-1080; ARO-11959.10-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Some further generalizations of the Farlie-Gumbel-Morgenstern distributions are described, and comparisons made among them. Author (GRA)

N77-17794# Syracuse Univ., N.Y. Dept. of Industrial Engineering and Operations Research.
AN EQUIVALENCE BETWEEN CONTINUOUS AND DISCRETE TIME MARKOV DECISION PROCESS Interim Report
Richard F. Serfonzo Jun. 1976 20 p refs
(Grants AF-AFOSR-2627-74; NSF ENG-75-13653; AF Proj. 9769)
(AD-A029337; AFOSR-76-1056TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A continuous time Markov decision process with bounded sojourn parameters (the parameters of the exponential sojourn times in the states) is shown to be equivalent to a simpler discrete time Markov decision process. This is for both the discounted and average cost criteria on an infinite horizon. This result follows from (1) an equivalence of certain functionals of equivalent Markov processes, and (2) the property that a continuous time jump Markov process with bounded sojourn parameters is equal in distribution to a similar Markov process whose sojourn parameters are all the same. Author (GRA)

N77-17795# Wisconsin Univ., Madison. Mathematics Research Center.
MINIMIZING THE (L SUB P, INFINITY)-DISTORTION OF TRIGONOMETRIC POLYNOMIALS Technical Summary Report
Zvi Ziegler Jun. 1976 16 p refs
(Contract DAAG29-75-C-0024)
(AD-A027891; MRC-TSR-1631) Avail: NTIS HC A02/MF A01 CSCL 12/1

The characterization of the trigonometric polynomial of degree less than or = n minimizing the ratio f sub p/f sub infinity, 1 less than or = p less than infinity, is presented. Properties of the zeros of such polynomials are then explored. Author

N77-17796# Wisconsin Univ., Madison. Mathematics Research Center.
BACKWARD ERROR ANALYSIS FOR TOTALLY POSITIVE LINEAR SYSTEMS Technical Summary Report
Carl DeBoor and Allan Pinkus Apr. 1976 18 p refs
(Contract DAAG29-75-C-0024; Grant NSF MPS-72-00381-A01)
(AD-A027892; MRC-TSR-1620) Avail: NTIS HC A02/MF A01 CSCL 12/1

A novel formulation of the results of Wilkinson's backward error analysis allows the conclusion that partial pivoting is not necessary when solving totally positive linear systems. This saves storage and time when computing spline interpolants. GRA

N77-17797# California Univ., Riverside. Dept. of Mathematics.
FASTER CONVERGENCE FOR ITERATIVE SOLUTIONS TO SYSTEMS VIA THREE PART SPLITTINGS Interim Report
John DePillis 1976 61 p refs
(Grant AF-AFOSR-2858-75; AF Proj. 9749)

(AD-A027857; AFOSR-76-0926TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

For the linear system Ax = y sub o, linear stationery second degree methods, or so-called three-part splittings (which include the first-degree methods of Jacobi, Gauss-Seidel and SOR) are explored for defining the sequence x sub n where x sub n approaches x. By measuring the asymptotic rates of convergence of the sequence, the determination is made when the second-degree method is superior to a corresponding first-degree method. In fact, if B is the iteration matrix of the first degree splitting, then this improvement is analyzed if the spectrum of B is real and when the spectrum of B is purely imaginary. GRA

N77-17798# ARO, Inc., Arnold Air Force Station, Tenn.
SOLUTION TO THE EULERIAN EQUATIONS BY THE FINITE ELEMENT METHOD WITH AN APPLICATION TO TRANSONIC FLOW Final Report, Nov. 1974 - Nov. 1975
W. J. Phares and K. R. Kneile AEDC Aug. 1976 36 p refs (ARO Proj. R33P-60A; ARO Proj. R33A-02A)
(AD-A028059; ARO-ETF-TR-76-30; AEDC-TR-76-86) Avail: NTIS HC A03/MF A01 CSCL 20/4

The Eulerian equations are solved by use of the finite element method (FEM) in conjunction with the Galerkin method of weighted residuals. The unsteady, nonconservative form of the equations is used to obtain the steady-state solution. Modifications are made in the time integration to improve stability at the cost of sacrificing the transient behavior. Numerical results are presented which compare reasonably well with other numerical solutions and with experimental data for transonic flow over airfoils.
Author (GRA)

N77-17799# Wisconsin Univ., Madison. Mathematics Research Center.
SOME MINIMAX THEOREMS AND APPLICATIONS TO NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS Summary Report
Paul H. Rabinowitz Jun. 1976 29 p refs
(Contracts DAAG29-75-C-0024; N00014-76-C-0300)
(AD-A029908; MCR-TSR-1633) Avail: NTIS HC A03/MF A01 CSCL 12/1

Using minimax methods, some existence theorems are proved for critical points of a real valued function on a Banach space. The critical points are of a saddle point type. Applications are made to semilinear elliptic partial differential equations. A perturbation theorem for the critical points is also proved in this context. Lastly applications are made to a family of nonlinear wave equations. GRA

N77-17800# Wisconsin Univ., Madison. Mathematics Research Center.
THE LANDAU PROBLEM FOR THE DIFFERENTIAL OPERATOR D SUPER 2-ALPHA SUPER 2 IN CIRCULAR RING
I. J. Schoenberg Jun. 1976 17 p refs
(Contract DAAG29-75-C-0024)
(AD-A029964; MRC-TSR-1645) Avail: NTIS HC A02/MF A01 CSCL 12/1

The present note is a continuation of a previous paper and uncovers an extremum property of the bounded exponential Euler splines for the differential operator L equal D(D sup 2) - (alpha sup 2). As such, these are special examples of Micchelli's cardinal L-splines. These connections are only mentioned to indicate how matters are related to spline theory, because here one proceeds directly, assuming no previous knowledge of it. GRA

N77-17801# Wisconsin Univ., Madison. Mathematics Research Center.
MULTIPLE INTEGRALS OF LIPSCHITZ FUNCTIONS IN THE CALCULUS OF VARIATIONS
Frank H. Clarke Jun. 1976 13 p refs
(Contract DAAG29-75-C-0024)
(AD-A029963; MRC-TSR-1644) Avail: NTIS HC A02/MF A01

The author considers a multiple integral problem in the calculus of variations in which the integrand is locally Lipschitz but not differentiable, and in which minimization takes place over a Sobolev space. Using a minimax theorem, the author derives an analogue of the classical Euler condition for optimally, couched in terms of 'generalized gradients'. The author proceeds to indicate how these results may be applied to deduce existence and smoothness properties of solutions to certain Poisson equations. GRA

N77-17802# Wisconsin Univ., Madison. Mathematics Research Center.
FOURIER TRANSFORM EVALUATION
J. Barkley Rosser Jun. 1976 13 p refs
(Contract DAAG29-75-C-0024)
(AD-A029962; MRC-TSR-1643) Avail: NTIS HC A02/MF A01 CSCL 12/1

Methods have been given for computing Fourier transforms which are particularly efficient at chosen discrete values of the, spectrum. Alternative methods based on Fourier series are presented for calculating the transform at additional values of the spectrum. GRA

N77-17803# Wisconsin Univ., Madison. Mathematics Research Center.
STRUCTURE OF RICCATI EQUATION SOLUTIONS IN OPTIMAL BOUNDARY CONTROL OF HYPERBOLIC EQUATIONS WITH QUADRATIC COST FUNCTIONALS
Hock Lye KPH Jun. 1976 218 p refs
(Contracts DAAG29-75-C-0024; N00014-75-C-0239; NR Proj. 041-404)
(AD-A029961; MRC-TSR-1642) Avail: NTIS HC A10/MF A01 CSCL 12/1

This paper concerns the question of minimizing a quadratic cost functional associated with a linear symmetric hyperbolic control system over a finite time interval. A necessary and sufficient condition for a solution to exist is developed in terms of the solution of a two-point boundary value problem (TPBVP). The TPBVP is solved under various conditions. The limit case of an infinite time interval is also considered. GRA

N77-17804# Delaware Univ., Newark. Dept. of Mathematics.
ITERATIVE SOLUTIONS OF BOUNDARY VALUE PROBLEMS Interim Report
Ralph E. Kleiman 1976 18 p refs
(Grant AF-AFOSR-2634-74; AF Proj. 9749)
(AD-A029928; AFOSR-76-1021TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Recent work has shown that Neumann's method in potential theory could be extended to solve boundary value and transition problems for the Helmholtz equation. The procedure consists of formulating the problem as a boundary integral equation which is then rewritten, with the use of a homographic transformation of the associated eigenvalue equation, so tht the spectral radius of the resulting integral operator is less than one for small perturbations of the corresponding potential operator. The present paper describes two extensions of this work. The transformation which maximizes the distance to the spectrum of the resolvent point of interest in potential theory (wave number equal to zero) is shown to be not optimal for non zero wave numbers. Thus while this transformation optimizes the rate of convergence of the Neumann series for zero wave number, this is not true in general. Some analytic and numerical examples are presented.
Author (GRA)

N77-17805# Naval Air Test Facility, Lakehurst, N.J.
GUIDELINES FOR ESTIMATION OF NON-LINEAR LEAST SQUARES POWER FUNCTIONS AND UPPER LIMIT CURVES
Wili K. Kraut 16 Jun. 1976 21 p refs
(AD-A029720; NATF-COS-10) Avail: NTIS HC A02/MF A01 CSCL 12/1

A non-linear least squares procedure for estimating power function coefficients is presented in this report. A procedure is recommended for obtaining associated prediction and tolerance upper limit curves. A technique to prevent outlier caused distortions in mean power functions and upper limit curves caused by outliers is also described. This report should be used as a user's guide at the Naval Air Test Facility (NATF) for generating power functions and upper limit curves. Examples given in this report provide the practitioner handy checkout guides. Rationale and justification underlying recommended procedures are given in Report NATF-COS-6, Application of Non-Linear Least Squares Procedures to Power /Functions and Upper Limit Curves. Author (GRA)

N77-17806# Naval Air Test Facility, Lakehurst, N.J.
APPLICATION OF NONLINEAR LEAST SQUARES PROCEDURES TO POWER FUNCTIONS AND UPPER LIMIT CURVES
Willi K. Kraut Jul. 1976 87 p refs
(AD-A029724; NATF-COS-6) Avail: NTIS HC A05/MF A01 CSCL 12/1

A non-linear least squares procedure for estimating mean power function curves is presented in this report. Prediction and tolerance upper limit curve expressions are derived by analogy with standard least squares methods. A chart of minimum widths for tolerance upper limit curves is given in this report. Data points used in the non-linear least squares procedure are checked for outliers and deficiencies to prevent distortions in calculated power functions and upper limit curves. The non-linear least squares method is compared with the standard least squares procedure for obtaining power function coefficient estimates and upper limit curves. For NATF (Naval Air Test Facility) applications the non-linear least squares procedure gives more consistant coefficient estimates than the standard method. Upper limit curves of the non-linear least squares procedure generally have smaller widths than standard method upper limit curves for large independent variable values. Sharper confidence bound definitions are therefore provided with the non-linear least squares procedure for critically important high independent variable values. It is shown in the report that non-linear least squares upper limit curves are in close agreement with exact upper limit curves of the straight line model. Author (GRA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-17807 Iowa State Univ. of Science and Technology, Ames.
INPUT-OUTPUT STABILITY OF INTERCONNECTED STOCHASTIC SYSTEMS Ph.D. Thesis
Robert Louis Gutmann 1976 125 p
Avail: Univ. Microfilms Order No. 77-1029

Input-output and absolute stability of stochastic systems was considered for systems with multiplicative white noise gain terms and for systems defined by stochastic nonlinear Volterra integral equations. Most of the techniques apply to large scale or composite systems in the sense that stability and instability were established by analysis of lower order subsystems and the interconnecting structure. The results represent a generalization of previous stochastic system stability and instability results to interconnected systems, as well as new frequency-domain results for single loop nonlinear systems endowed with multiplicative white noise gain terms. Frequency-domain techniques are emphasized where appropriate. Dissert. Abstr.

N77-17808# California Univ., Livermore. Lawrence Livermore Lab.
TABLES OF CONFIDENCE BOUNDS FOR FAILURE PROBABILITIES
J. G. Huebel and G. K. Myers 8 Jan. 1976 53 p refs
(Contract W-7405-eng-48)
(UCRL-51990) Avail: NTIS HC A04/MF A01

The problems of determining population failure level bounds from sample failure levels and how confidence is influenced by sample size are discussed. Two sets of failure probability confidence bounds are tabulated. One set is derived for normally distributed populations and is based on the noncentral t distribution. The other set is derived nonparametrically - that is, without assuming the population distribution - and is based on the binomial distribution. These tables convert sample failure levels into population failure probability bounds. Author (ERA)

N77-17809# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SAMPLE-SIZE DETERMINATION FOR A RANDOM VARIABLE OF BONDED VARIATION. 2: THE UNIMODAL CASE Final Report
Stephen S. Wolf Aug. 1976 14 p refs
(DA Proj. 1W6-62618-AH-80)
(AD-A028352; BRL-1898) Avail: NTIS HC A02/MF A01 CSCL 12/1

An algorithm is given for determining the sample size required to estimate the mean of a unimodal random variable of bounded variation. The (new) assumption of unimodality permits substantial reductions in required sample size. Author (GRA)

N77-17810# North Carolina Univ., Chapel Hill.
QUANTILE ESTIMATION METHODS FOR DISCRETE EVENT SIMULATIONS OF REGENERATIVE SYSTEMS Ph.D. Thesis
Andrew F. Seila Jul. 1976 253 p refs
(Contract N00014-76-C-0302)
(AD-A028495; TR-76-12) Avail: NTIS HC A12/MF A01 CSCL 12/1

D. L. Iglehart has proposed a method for estimating quantiles in regenerative processes. The method of averaging (MA) estimator is proposed and evaluated as an alternative to Iglehart's method. It is shown that the method of averaging is conceptually simpler and easier to implement than Iglehart's method, and under appropriate circumstances, the estimator has the same asymptotic normal distribution as Iglehart's estimator. Simulation results using the .9-quantile of waiting time in the M/M/1 queue show that the MA estimator is seriously biased; however, when the jackknife technique is applied, the method of averaging performs comparably with Iglehart's method. The method of averaging appears to be preferable for estimating quantiles in discrete event simulations of regenerative systems. Author (GRA)

N77-17811# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
ONE SIDED PREDICTION INTERVALS FOR NORMAL AND LOG-NORMAL DISTRIBUTIONS WITH TABLES, 2
Kenneth W. Fertig and Nancy R. Mann 30 Nov. 1975 20 p refs
(Contract N00014-75-C-0474; NR Proj. 042-321)
(AD-A028327) Avail: NTIS HC A02/MF A01

A simplified method for computing exact one-sided prediction intervals for Gaussian processes is presented along with tables of coefficients necessary to obtain actual prediction intervals. The tables pertain to selected values of current sample size, n, future sample size, m, and number of items, m-l, in a future sample to be included in the prediction interval. The table gives coefficients for n = 2(1)15(5)30(10)50, infinity, m = 20,25,30(10)80, and l = 1(1)8. An example is provided which demonstrates the use of the table. Author

N77-17812# Wisconsin Univ., Madison. Mathematics Research Center.
SOME ASYMPTOTIC RESULTS FOR OCCUPANCY PROBLEMS Technical Summary Report
Lars Holst Apr. 1976 18 p refs
(Contract DAAG29-75-C-0024)
(AD-A027885; MRC-TSR-1600) Avail: NTIS HC A02/MF A01 CSCL 12/1

Consider a situation in which balls are falling into N cells with arbitrary probabilities. Limit distributions for the number of empty cells are considered when N nears infinity and the number of balls n nears infinity so that n/N nears infinity. Limit distributions for the number of balls to achieve exactly b empty cells are obtained when N nears infinity for b fixed or b near infinity so that b/N nears 0. GRA

N77-17813# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE POSTERIOR DISTRIBUTION OF A DIRICHLET PROCESS GIVEN RANDOMLY RIGHT CENSORED OBSERVATIONS
J. Blum and V. Susarla Mar. 1976 15 p refs
(Contract DAAG29-75-C-0024)
(AD-A027889; MRC-TSR-1618) Avail: NTIS HC A02/MF A01 CSCL 12/1

The purpose of this note is to show that the conditional distribution of a Dirichlet process given n idendependent randomly right censored observations from it is a mixture of Dirichlet processes as introduced by Antoniak. This result gives yet another application of mixtures of Dirichlet processes to Bayesian

decision problems concerning a random survival distribution. GRA

N77-17814# Wisconsin Univ., Madison. Mathematics Research Center.
ON MULTINOMIAL SUMS Technical Summary Report
Lars Holst May 1976 22 p refs
(Contract DAAG29-75-C-0024)
(AD-A027897; MRC-TSR-1629) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method for obtaining the limit distributions of random variables is given. Principally, the case with equal probabilities and the same function h(.) is considered. As an application a limit result is derived for the distribution of the maximum frequency in a random vector with a symmetric multinomial distribution. The limit theorems generalize and unify results obtained for different variants of occupancy problems. Author

N77-17815# Army Missile Command, Redstone Arsenal, Ala. Cost Analysis Div.
DEPENDENT (CONDITIONAL) PROBABILITY ASPECTS OF COST ESTIMATING
Edward L. Murphy, Jr. Aug. 1976 17 p refs
(AD-A029318) Avail: NTIS HC A02/MF A01 CSCL 12/2

An analytical procedure can be applied to provide decision makers with insight for making an optimum decision. The procedure is not limited to consideration of only three variables. It can be applied to evaluate conditional aspects of performance cost or time of one part of a system with one or more parts of the same or other systems. GRA

N77-17816# Nuclear Regulatory Commission, Washington, D.C. Applied Statistics Group.
SERIES ON STATISTICAL APPLICATION AND METHODOLOGY ON THE USE OF CONFIDENCE INTERVALS AS PROBABILITY INTERVALS
Robert G. Easterling Jun. 1976 17 p refs
(PB-258233/6; NR/ASG-001) Avail: NTIS HC A02/MF A01 CSCL 12A

The practice of using statistical confidence intervals as probability intervals in studies of system uncertainties is examined. In several examples, most of which relate to system reliability analysis, it is shown that this practice can lead to intervals which have almost no chance of containing the quantity of interest and that system failure probabilities may be considerably overestimated. Since appropriate statistical methods for obtaining confidence intervals for system functions are available, it is concluded that the practice of treating confidence intervals as probability intervals can and should be avoided. GRA

N77-17817# Yale Univ., New Haven, Conn. School of Organization and Management.
BIASED VARIANCE ESTIMATORS FOR STATISTICAL INVENTORY POLICIES
John G. Klincewicz Aug. 1976 32 p refs
(Contract N00014-75-C-0241; Grant DAHC04-75-G-0079; NR Proj. 047-140; ARO Proj. P-11639-M)
(AD-A028960; TR-8) Avail: NTIS HC A03/MF A01 CSCL 05/1

In practice, scientific inventory decisions frequently are based on statistical estimates of the mean mu and variance ((s sup 2) of demand. This report examines the efficacy of modified variance estimates of the form beta (s sup 2), where the scaling factor beta is selected according to the criterion of minimizing expected total operating cost per period. Simulation experiments are run with a number of economic parameter settings for both cases of known and statistically estimated mean, and the value of using a beta value other than unity is assessed. GRA

N77-17818# Wisconsin Univ., Madison. Mathematics Research Center.
ESTIMATION OF THE MULTI-DEMENSIONAL PROBABILITY DENSITY FUNCTION
J. Kuelbs Jul. 1976 21 p refs
(Contract DAAG29-75-C-0024)
(AD-A029965; MRC-TSR-1646) Avail: NTIS HC A02/MF A01 CSCL 12/1

Suppose X1,X2,... are independent, identically distributed (i.i.d.) (R sup d) valued random variables with common probability density function f. A problem of considerable practical importance and also of theoretical interest is the estimation of f through some statistic based on the observed sequence (X sub k). Such statistics are called empirical density functions, and the author examines the rate of convergence of the empirical densities to f. The author also considers the situation when there is 'noise' in the observations (X sub k). GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-17819*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRESSURE MODEL OF A FOUR-WAY SPOOL VALVE FOR SIMULATING ELECTROHYDRAULIC CONTROL SYSTEMS
Vernon D. Gebben Washington Dec. 1976 33 p refs
(NASA-TN-D-8306; E-8820) Avail: NTIS HC A03/MF A01 CSCL 12B

An equation that relates the pressure flow characteristics of hydraulic spool valves was developed. The dependent variable is valve output pressure, and the independent variables are spool position and flow. This causal form of equation is preferred in applications that simulate the effects of hydraulic line dynamics. Results from this equation are compared with those from the conventional valve equation, whose dependent variable is flow. A computer program of the valve equations includes spool stops, leakage spool clearances, and dead-zone characteristics of overlap spools. Author

N77-17820*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACECRAFT DESIGN SENSITIVITY FOR A DISASTER WARNING SATELLITE SYSTEM
Joseph E. Maloy, Charles E. Provencher, Bruce E. LeRoy, Richard C. Braley, and Howard A. Shumaker Washington Feb. 1977 45 p refs
(NASA-TM-X-3469; E-8856) Avail: NTIS HC A03/MF A01 CSCL 12B

A disaster warning satellite (DWS) is described for warning the general public of impending natural catastrophes. The concept is responsive to NOAA requirements and maximizes the use of ATS-6 technology. Upon completion of concept development, the study was extended to establishing the sensitivity of the DWSS spacecraft power, weight, and cost to variations in both warning and conventional communications functions. The results of this sensitivity analysis are presented. Author

N77-17821# Bristol Univ. (England). Dept. of Aeronautical Engineering.
RECTIFICATION THROUGH FRICTION AND BACKLASH B.S. Thesis
D. A. Cowling Jun. 1976 65 p refs
(BU-196) Avail: NTIS HC A04/MF A01

The modelling of rectification due to friction and backlash is described by using three techniques, namely digital computer modelling, analog modelling, and mechanical modelling. Single and two degree of freedom systems were studied. The results from the single degree system models show some predictability though all variables have been limited to small ranges. Excitation frequencies between 10 and 25 Hz and 'g' levels between 3 and 6 were studied. The two degree results showed the relative phase of excitation of each freedom to be important. Finally it is suggested that there may be some correspondence between the behavior of one and two degree of freedom systems. Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-17822# Cornell Univ., Ithaca, N.Y. Dept. of Computer Science.
ON THE REACHABILITY PROBLEM FOR 5-DIMENSIONAL VECTOR ADDITION SYSTEMS
John Hopcroft and Jean-Jacques Pansiot Jun. 1976 48 p refs
(Contract N00014-67-A-0077-0021)
(AD-A028030; CU-CSD-76-280) Avail: NTIS HC A03/MF A01 CSCL 12/1

The reachability set for vector addition systems of dimension less than equal to five are shown to be effectively computable semilinear sets. Thus reachability, equivalence and containment are decidable up to dimension 5. An example of a non-semilinear reachability set is given for dimension 6. GRA

N77-17823# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
RESTRICTED GENERIC BIFURCATION Interim Report
Jack K. Hale Mar. 1976 35 p refs
(Contract DAAG29-76-C-0052; Grants AF-AFOSR-2078-71C; NSF GP-28931; AF Proj. 9769)
(AD-A027854; AFOSR-76-0849TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In the past few years, there has been considerable attention devoted to the existence of bifurcation for one parameter families of mappings. Concurrent with this development has been the extensive theory of the universal unfolding of mappings or generic bifurcation for families of mappings which depend on a sufficiently large number of parameters. The purpose of this paper is to discuss methods for determining the nature of bifurcation when the family of mappings has k = 1 parameters, but k is generally smaller than the number of parameters necessary to describe the universal unfolding. Author (GRA)

N77-17824# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
STABILITY IN NEUTRAL EQUATIONS Interim Report
Jack K. Hale and Pedro Martinez-Amores 4 Feb. 1976 31 p refs
(Grants AF-AFOSR-2078-71; NSF GP-28931; DAHC04-75-G-0077)
(AD-A027855; AFOSR-76-0850TR) Avail: NTIS HC A03/MF A01 CSCL 12/2

Stability of linear systems and the problem of absolute stability were discussed using Laplace transform and frequency domain method. By differentiating the difference equation, a system of neutral differential difference equations is obtained, and solutions of the original problem are determined by restricting the initial data. Author

N77-17825# Wisconsin Univ., Madison. Mathematics Research Center
KOROVKIN SHADOWS AND KOROVKIN SYSTEMS IN C(S)-SPACES
D. Amir (Tel-Aviv Univ., Israel) and Z. Ziegler (Techion, Haifa, Israel) Jun. 1976 68 p refs
(Contract DAAG29-75-C-0024; Grant NSF MPS-71-02905-A03)
(AD-A029960; MRC-TSR-1638) Avail: NTIS HC A04/MF A01 CSCL 12/1

The relationship between various types of Korovkin shadows is explored. An intrinsic characterization of Korovkin subspaces and Korovkin shadows is given. For some cases the detailed structure of the Korovkin shadows is presented. GRA

N77-17292# Osaka Univ. (Japan). Dept. of Applied Physics.
ON THE BOUNDARY BEHAVIOR OF HARMONIC MEASURES
Fumio Maitani *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 373-380 refs (For primary document see N77-17291 08-31)
(Rept-1308) Avail: NTIS HC A10/MF A01

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-17826*# Borg-Warner Thermoelectrics, Des Plaines, Ill.
THERMOELECTRICALLY COOLED CLOUD PHYSICS EXPANSION CHAMBER Final Technical Report
Richard J. Buist 31 Jan. 1977 125 p
(Contract NAS8-31633)
(NASA-CR-150187) Avail: NTIS HC A06/MF A01 CSCL 14B

The design and fabrication of a thermoelectric chiller for use in chilling a liquid reservoir is described. Acceptance test results establish the accuracy of the thermal model and predict the unit performance under various conditions required by the overall spacelab program. Author

N77-17827# Thyssen Edelstahlwerke A.G., Krefeld (West Germany). Hauptabteilung Werkstoffe.
DEVELOPMENT OF PERMANENT MAGNETS BASED ON RARE EARTH - COBALT ALLOYS Final Report
Gerhard Schaefer and Wolfgang Spyra Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1976 282 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-98)
(BMFT-FB-T-76-37) Avail: NTIS HC A13/MF A01; ZLDI, Munich, DM 58.80

Powder milling, sintering, and extrusion tests were carried out on vacuum melted alloys to determine the optimum processing conditions for the production of permanent magnets from Co sub 5 CeMM, Co sub 5 Sm, and Co sub(5-x) Cu sub x CeMM alloys. Co-Cu-(Fe)-CeMM-alloys were tested for their suitability as cast magnets. The investigations included constitution research in the Co-CeMM system, the determination of the milling and sintering characteristics and of the magnetic properties. Energy product data led to the conclusion that an economical production, using simple manufacturing steps, of permanent magnets based on CoRE alloys is possible. Author (ESA)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-17828*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EVALUATION OF METHODS OF REDUCING COMMUNITY NOISE IMPACT AROUND SAN JOSE MUNICIPAL AIRPORT
Jan M. Glick (Stanford Univ., Calif.), Richard S. Shevell (Stanford Univ., Calif.), and Jeff V. Bowles Nov. 1975 64 p refs
(NASA-TM-X-73077; A-6346) Avail: NTIS HC A04/MF A01 CSCL 20A

A computer simulation of the airport noise impact on the surrounding communities was used to evaluate alternate operational procedures, improved technology, and land use conversion as methods of reducing community noise impact in the airport vicinity. In addition, a constant density population distribution was analyzed for possible application to other airport communities with fairly uniform population densities and similar aircraft operational patterns. The introduction of sound absorption material (SAM) was found to reduce community noise annoyance by over 25 percent, and the introduction of refan was found to reduce community annoyance by over 60 percent. Replacing the present aircraft was found to reduce the noise problem to very small proportions, and the introduction of an advanced technology twin was found to essentially eliminate the community noise problem. Author

DATA SUMMARY: Operational procedures, sound absorbing materials, and engine modifications for noise reduction; the variables include segmented approach, cutback takeoff, engine retrofitting, acoustic liners, land use, flight path angle, thrust

cutback, and high bypass ratio jet engines; 17 figures and 16 tables include numeric data.

N77-17829*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
EXPLORATORY INVESTIGATION OF AEROACOUSTIC OPTIMIZATION OF THE VARIABLE IMPEDANCE EDGE CONCEPT APPLIED TO UPPER SURFACE BLOWN CONFIGURATIONS
Richard E. Hayden Nov. 1976 87 p refs
(Contract NAS1-13896)
(NASA-CR-145072; BBN-3245) Avail: NTIS HC A05/MF A01 CSCL 20A

The feasibility of using porous surfaces on lift augmentation flaps to reduce the noise at the source, without adversely affecting aerodynamic performance was investigated. Numerous flap configurations were tested on a USB (upper surface blowing) type powered lift model (approximately 1/5 full scale). Significant reductions of far field noise and aeroacoustic pressures were found, and many configurations exhibited aerodynamic characteristics comparable to unmodified configurations of the nozzle/flap system. Author

DATA SUMMARY: Diverse data are presented; variables include sound pressure, frequency, acoustic resistance, flow resistance, weight, thickness, tensile strength, noise reduction, Strouhal number, total force, nozzle pressure ratio.

N77-17830*# Tennessee Univ. Space Inst., Tullahoma.
ACOUSTIC SOURCE LOCATION IN A JET-BLOWN FLAP USING A CROSS-CORRELATION TECHNIQUE Final Report
Robert S. Becker and James R. Maus Feb. 1977 176 p refs
(Grant NGR-43-001-135)
(NASA-CR-149589) Avail: NTIS HC A09/MF A01 CSCL 20A

The acoustic source strength distribution in a turbulent flow field was measured for two far field microphones at 45 deg above and below the plane of the flap surface. A processed signal from an inclined hot-film anemometry probe was cross correlated with the signal from the appropriate far field microphone. The contribution made by the sources associated with the fluctuating pressure on the flap surface to the sound received at far field microphone was estimated by cross correlating the processed signals of microphones which were embedded in the flap surface with the far field microphone signals. In addition, detailed fluid dynamic measurements were made in the flow field of the jet flap using dual sensor hot-film anemometry probes. Author

DATA SUMMARY: Diverse data are presented; variables include velocity, axial position, turbulence intensity, Reynold's stress, sound pressure, frequency, correlation function, momentum, distance, acoustic source strength.

N77-17831# Knolls Atomic Power Lab., Schenectady, N.Y.
CALCULATIONAL MODEL FOR THE SHEAR WAVE ECHO FROM SUBSURFACE PLANAR FLAWS
Frank V. Ammirato 1976 20 p refs Presented at Eastern Testing Conf., Hartford, 4 May 1976
(Contract W-31-109-eng-52)
(KAPL-P-4044; Conf-760506-1) Avail: NTIS HC A02/MF A01

A mathematical model was constructed to predict the echo from planar reflectors whose flanks do not necessarily intersect a surface of the material being ultrasonically tested. The amplitudes and relative phases of the scattered waves returning to the transducer from a reflector of arbitrary size, angle of inclination, and location were calculated. Directional characteristics of the reflector and receiver were accounted for. Experimental measurements were in good agreement with calculations. It was shown that reflections from subsurface flaws are strongly dependent on test conditions and that the reflection from an interior reflector can be significantly less than that from a surface reflector of the same size. ERA

DATA SUMMARY: Numerical and experimental analyses of echoes from planar reflectors; variables include amplitude, distance, reflector size, angle of inclination, beam angles; 6 figures include numeric data.

N77-17832# Maryland Univ., College Park. Dept. of Physics and Astronomy.
NOISE MEASUREMENTS OF THE LOWEST FREQUENCY LONGITUDINAL MODE OF AN ALUMINUM CYLINDER AT LIQUID NITROGEN TEMPERATURE Final Report
William S. Davis 1976 24 p refs
(Contract N00014-76-C-0428)
(AD-A029046) Avail: NTIS HC A02/MF A01 CSCL 20/1

The lowest frequency longitudinal mode of an aluminum cylinder has been studied over the temperature range 60K - 78K. Lead zirconate titanate crystals were bonded to the cylinder for observation of the thermal fluctuations, and relaxation phenomena. Large amounts of excess noise were observed whenever the cylinder was not in thermal equilibrium. The cylinder appeared to have attained thermal equilibrium after its temperature had been maintained near liquid nitrogen temperatures for several weeks. Noise temperatures within a factor 2 of the temperature measured by a platinum resistance thermometer were observed when the mean temperature of the cylinder was drifting less than 0.01 degree Kelvin per day. The very large fluctuations in noise temperature are not understood and warrant further investigation. Author (GRA)

DATA SUMMARY: Noise temperature and parameters were measured; variables include thermal fluctuations, temperature, nitrogen equilibrium vapor pressure, and independent variables; 3 tables include numeric data.

N77-17833# Pennsylvania State Univ., University Park. Applied Research Lab.
NOISE GENERATED BY AXISYMMETRIC TURBULENT BOUNDARY LAYER FLOW
G. C. Lauchle 1 Jul. 1976 42 p refs
(Contract N00017-73-C-1418)
(AD-A028320; TM-76-187) Avail: NTIS HC A03/MF A01 CSCL 20/4

The noise generated by hydrodynamic flow over an axismmetric body with a blunt nose is described quantitatively. Flush-mounted piezoceramic hydrophones were used to measure that part of the turbulent boundary layer pressure fluctuations that propagates as true sound. The nose of the test model was blunt, flat in the stagnation region, and then fairing into a cylinder by an elliptical contour. The small transducers were mounted at the stagnation point, at the outer edge of the flat area, along the elliptical contour, and along the cylindrical section. Power spectra of the sound pressure were measured in a 3 - 50 kHz frequency range over a wide range of Reynolds numbers. GRA

DATA SUMMARY: Noise spectra under ten different conditions were measured; variables include nondimensional axial length, frequencies, body diameter Reynolds number, critical arc length, nondimensional body radius, momentum thickness Reynolds number, arc length Reynolds number, intermittency factor, nondimensional boundary layer, and nondimensional frequencies; 18 figures and 1 table include numeric data.

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-17834# Rensselaer Polytechnic Inst., Troy, N.Y.
ENERGY AND ANGULAR MOMENTUM DEPENDENCE OF COMPLETE FUSION CROSS SECTIONS
E. Seglie and D. Sperber 1976 21 p refs Sponsored by ERDA
(COO-3463-21) Avail: NTIS HC A02/MF A01

A model for the calculation of the cross section for complete fusion in heavy ion reactions is suggested. The model does not explicitly depend on the sharp cut-off approximation. On the contrary, it allows for a gradual transition between compound and direct process when the bombarding energy is sufficiently

high above the coulomb barrier. The energy below which the reaction cross section is exhausted by compound processes is also estimated. Comparison with experimental results supports the validity of the model. ERA

N77-17835# Sandia Labs., Albuquerque, N.Mex.
RELATIVISTIC ORBITAL AND ENTIRE-ATOM COMPTON-PROFILES FOR THE ELEMENTS
F. Biggs, L. B. Mendelsohn, and J. B. Mann Jan. 1976 7 p refs
(Contract AT(29-1)-789)
(SAND-75-0636) Avail: NTIS HC A02/MF A01

Tables of orbital and entire-atom Compton profiles were given for the elements of atomic numbers 1 less than or equal to Z less than or equal to 102. Relativistic Dirac-Hartree-Fock wave functions were used in the numerical calculations. Author (ERA)

N77-17836# Los Alamos Scientific Lab., N.Mex.
EXPLANATION OF THE SELECTIVE DISSOCIATION OF SF6 MOLECULES IN A STRONG INFRARED LASER FIELD
R. V. Ambartsumian, Yu. A. Gorokhov, V. S. Letokhov, G. N. Makarov, and A. A. Puretskii [1976] 9 p refs Transl. into ENGLISH from Zh. Exsp. Teor. Fiz. (USSR), v. 23, 1976 p 26-30
(LA-TR-76-9) Avail: NTIS HC A02/MF A01

Experimental results for the frequency and power dependence of the selective dissociation rate of SF6 molecules by infrared laser radiation are presented. On the basis of these results, a possible mechanism for the process is offered. ERA

N77-17837# California Univ., Berkeley. Lawrence Berkeley Lab.
TARTNP USER'S MANUAL
J. Kimlinger and E. Plechaty 9 Feb. 1976 29 p
(Contract W-7405-eng-48)
(UCID-17026) Avail: NTIS HC A03/MF A01

The operating instructions and input definitions are given for the TARTNP Monte Carlo neutron/photon transport code. The limitations of the code and the pitfalls that may be encountered in using it are also described. ERA

N77-17838# Florida State Univ., Tallahassee.
EXPERIMENTAL STUDY OF NUCLEAR MODELS. 1: DECAY SCHEMES AND NUCLEAR REACTIONS. 2: MUONIC X-RAY STUDIES Progress Report, 1 Oct. 1975 - 31 Aug. 1976
Raymond K. Sheline 31 Aug. 1976 51 p refs
(Contract AT(40-1)-2434)
(ORO-2434-12) Avail: NTIS HC A04/MF A01

Progress in the study of the shell model is reported. It was determined that the model predicts the energy levels in Pb-209 and the cross sections produced from the reaction Bi-210(m)(tau, alpha)Pb-209. Transitional nuclei were examined using nuclear reaction spectroscopic tools. Other topics studied include deformed nuclei, altered cross sections for (d,p) or (d,t) reactions on mixed target ground states; shell effects for g=0.6; recoupled bands; isotopic substitution of metal carbonyls; and muonic X-rays. J.M.S.

N77-17839# National Bureau of Standards, Washington, D.C.
X-RAY PHOTOEMISSION STUDIES AND BONDING IN AMORPHOUS CHALCOGENS Interim Technical Report
Galen B. Fisher and Richard B. Shaluoy (Brown Univ.) 5 Aug. 1976 9 p refs
(NR Proj. 056-573; RR0130801; Contract NAonr-18-76)
(AD-A028811) Avail: NTIS HC A02/MF A01 CSCL 07/4

Trends in X-ray photoelectron (XPS) spectra of chalcogens which relate to their bonding are discussed. Valence band spectra of disordered S are reported along with measurements in the same apparatus of amorphous Se and Te. Each chalcogen's spectrum has a minimum about 7 eV below E(F), between the largely p-derived states nearer E(F) and the s-derived states. The p states are split into a largely non-bonding level near E(F) and a bonding peak an energy delta E(P) below it. The splitting delta E(P) (S, 3.5 eV; Se, 2.9 eV; Te, 2.2 eV) grows with decreasing atomic number, Z, and is found to scale with Pauling's bond energies. The s states exhibit an apparent bonding-antibonding splitting which grows with decreasing Z and scales with the increasing overlap of the s orbitals. Although the s states overlap, comparisons with calculated valence levels in the free atom suggest that most of the cohesive energy in the chalcogens is gained by the bonding of the p electrons, with no major contribution from the s electron. GRA

N77-17277*# Naval Research Lab., Washington, D.C.
EFFECTS OF NEUTRON IRRADIATION ON THE CHARACTERISTICS OF A BURIED CHANNEL CCD AT 80 DEGREES KELVIN AND 295 DEGREES KELVIN
N. S. Saks, J. M. Killiany, and W. D. Baker *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 110-114 refs (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 18H

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N77-17840*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PRELIMANARY AREA SURVEY OF NEUTRON RADIATION LEVELS ASSOCIATED WITH THE NASA VARIABLE ENERGY CYCLOTRON HORIZONTAL NEUTRON DELIVERY SYSTEM
W. K. Roberts and R. Leonard Dec. 1976 14 p ref
(NASA-TM-X-73577; E-9035) Avail: NTIS HC A02/MF A01 CSCL 21H

The 25 MeV deuteron beam from the NASA variable energy cyclotron incident on a thick beryllium target will deliver a tissue neutron dose rate of 2.14 rad micron A-min at a source to skin distance of 125 cm. A neutron survey of the existing hallways with various shielding configurations made during operating of the horizontal neutron delivery system indicates that minimal amounts of additional neutron shielding material are required to provide a low level radiation environment within a self-contained neutron therapy control station. Measurements also indicate that the primary neutron distribution delivered by a planned vertical delivery system will be minimally perturbed by neutrons backscattered from the floor. Author

N77-17841# Los Alamos Scientific Lab., N.Mex.
CALCULATION OF RADIATION DAMAGE EFFECTS OF 800-MeV PROTONS IN A 'THIN' COPPER TARGET
C. Alton Coulter, Don M. Parkin, and Walter V. Green Mar. 1976 24 p refs
(Contract W-7405-eng-36)
(LA-6294-MS) Avail: NTIS HC A02/MF A01

Radiation damage effects of 800-MeV protons incident on a 1-cm-thick copper target were calculated by using the nucleon-meson transport code to determine the nuclear reactions produced by the protons, and the theory of Lindhard et al to evaluate the resultant damage energy deposited in the target. Damage effects were found to be uniform across the 1-cm target thickness, and the results obtained can be expressed in cross-section form applicable to target thickness from about 0.01 cm to 2 cm. The calculation yielded a damage energy cross section (depending somewhat on beam and target geometry) of about 350 barn-keV and a nuclear transmutation cross section of 1.0 barn, and indicated copious proton, neutron, and helium production. Comparison of the cross sections obtained with those of several neutron spectra of reactor interest suggests that medium energy proton bombardment may be a useful method for simulating neutron induced radiation damage effects. ERA

N77-17842# Science Applications, Inc., Rolling Meadows, Ill.
STUDY OF RADIATION DOSAGE TO STRUCTURAL COMPONENTS IN NUCLEAR REACTORS Final Report
Laurence B. Miller, Richard E. Jarka, and Dean C. Kaul Jan. 1976 238 p refs
(EPRI Proj. 304-1)
(PB-257567/8; EPRI-NP-152) Avail: NTIS HC A11/MF A01 CSCL 18I

The calculated neutron and gamma ray distributions may be used to estimate the total radiation exposure to which a reactor component is exposed over a period of time for the two generic reactor systems studied. The accurate knowledge of these radiation levels can be used to estimate the safety and licensibility of the pressure vessel and in-vessel components. GRA

N77-17843# Memphis State Univ., Tenn. Center for Nuclear Studies.
MOBILE NUCLEAR POWER PLANTS: INITIAL FEASIBILITY STUDY
D. W. Jones May 1976 39 p refs
(Grant EDA-PF-508)
(PB-258232/8; EDA/OER-76/029) Avail: NTIS HC A03/MF A01 CSCL 18E

The use of mobile reactors is proposed for utilizing nuclear energy to satisfy industrial energy needs in areas of our nation where primary fuels and other energy resources are not available. This alternative is cost competitive with oil and some forms of coal and will provide both steam and electrical power at industrial plant sites. Both technical and economic feasibilities of this energy resource are described and a program outlined for its development. Recommendations are also made that a demonstration project be started to establish the feasibility of this alternative. GRA

N77-17844# Nihon Univ., Tokyo (Japan). Dept. of Physics.
DYNAMICAL THEORY OF HADRON INTERACTIONS BASED UPON EXTENDED PARTICLE PICTURE 2: CONSTRUCTION OF THE HADRON INTERACTIONS
Osamu Hara [1976] 28 p refs
(NUP-A-76-9) Avail: NTIS HC A03/MF A01

The interaction of hadron is discussed on the basis of an extended particle model. It is assumed that the interaction between hadrons is due to the coupling between currents carried by excitons excited in the particles, which is mediated by some intermediate field. This original interaction between excitons is given - thus leading to a unified and a dynamical understanding of the hadron interactions. The resulting meson-meson interactions and the meson-baryon interactions are in agreement with those obtained by SU6 or its relativistic generalization. A great advantage of this model is that it gives new relations between these meson-meson interactions and meson-baryon interactions because of its unified structure. Author

N77-17845# Nihon Univ., Tokyo (Japan). Dept. of Physics.
MINIMAL BOOSTING OF SU(6) SCHEME
Shin Ishida, Azusa Matsuda, and Mikio Namiki [1976] 32 p refs
(NUP-A-76-5) Avail: NTIS HC A03/MF A01

A Lorentz transformation character of the SU(6) scheme for mesons and baryons. A characteristic feature of the scheme is that the wave functions have a minimal number of components compared to all possible ones, and the scheme is called as minimally boosted SU(6). Author

N77-17274*# ITT Electro-Physics Labs., Inc., Columbia, Md. Avionics Div.
ELECTRON BEAM IRRADIATION OF THINNED BACKSIDE ILLUMINATED CCDS
G. M. Borsuk, J. A. Green, R. N. DeWitt, and J. M. Milliany (Naval Res. Lab., Washington, D.C.) *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 95-100 refs
(For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 20J

74 OPTICS

Includes light phenomena.

N77-17846*# Southern Univ., Baton Rouge, La. Dept. of Mechanical Engineering.
DETERMINATION OF PARTICLE SIZE USING MEASUREMENT OF SCATTER TO NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Final Report
Robert Lloyd Scott, Jr. Oct. 1976 43 p
(Grant NsG-8029)
(NASA-CR-149652) Avail: NTIS HC A03/MF A01 CSCL 20F

Scatter from glass beads placed on a mirror was measured using a quartz lamp and laser. Data were obtained in the plane containing the normal to the surface and the incident beam. For the quartz lamp the best correlation can be obtained for data measured at a zenith of 55 deg and 180 deg from the incident beam. The best correlation when the laser is used is obtained at about the same position. However, the correlation variables are angular spacing of the minimums of the data versus the size. Whereas, with the quartz lamp the correlation variables are the amount of scattered energy versus size. Author

DATA SUMMARY: Measurements of scatter from glass beads at different zenith and azimuth angles of the source and detector; variables include reflectance, angle, scatter, size, angular spacing, diameter; 10 figures and 12 tables include numeric data.

N77-17847# Zeiss (Carl), Oberkochen (West Germany). Abteilung Math-Photo.
OPTIMIZATION OF OPTICAL SYSTEMS Final Report
Fritz Determann, Helmut Fischer, Erhard Glatzel, Martin Krautter, and Gerhard Scheid Bonn Bundesmin. fuer Forsch. u. Technol. Jul. 1976 155 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-96)
(BMFT-FB-T-76-27) Avail: NTIS HC A08/MF A01; ZLDI, Munich, DM 32.15

In the adaptive automatic correction program for the optical systems of E. Glatzel two new features were introduced: The pivots of the matrix inversions, the comparison of which indicates the mutual dependence of the aberrations, were used to control the procedure. An attempt was made to use the properties of the modulation transfer functions calculated under certain conditions to control the procedure. Author (ESA)

DATA SUMMARY: Diverse data are presented; variables include optical transfer function, focusing, asphericity, pivot arrangement, lens geometry, lens thickness, matrix methods, phase modulation, and image enhancement.

N77-17848# Southwest Research Inst., San Antonio, Tex.
HEADLIGHT REQUIREMENTS IN 1990-COST-BENEFITS AND MINI-FIELD TRIAL OF POLARIZED HEADLIGHTS Final Report, May 1975 - May 1976
Roger H. Hemion and Roy W. Hull Aug. 1976 130 p refs
(Contract DOT-HS-5-01149)
(PB-258145/2; SwRI-AR-1055; DOT-HS-801-980) Avail: NTIS HC A07/MF A01 CSCL 13F

A study of future headlamp design requirements based on the predicted trends in vehicles, drivers and traffic to 1990 shows the need for improvements beyond those obtainable from current, normal, unpolarized types, particularly if road speeds above 55 mph are again authorized. A cost-benefit analysis of the nationwide adoption of polarized headlighting by 1990 shows benefits, in the avoidance of nighttime accidents, in the range of 2.5 to 3.8 to 1 over the costs of implementing polarization. An on-the-road field test with twenty average drivers and ten vehicles equipped with polarized headlights, showed that distances at which low reflectivity roadside targets could be detected improved with increased polarized light output from the headlamps. GRA

DATA SUMMARY: The automobiles for various production years are compared to the accident rate, costs, and headlight glare; variables include year, population, detection distance, percent polarizer transmission/percent analyzer transmission, mph, accidents and costs, percent vehicle exceeding speed, fuel consumption, and glare recovery; 21 figures and 12 tables include numeric data.

N77-17276*# Westinghouse Electric Corp., Baltimore, Md.
X-RAY QUANTUM EFFICIENCIES OF CCD'S
Martin Peckerar, W. D. Baker, and D. J. Nagel *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 106-109 refs Sponsored by ONR Prepared in cooperation with NRL, Washington, D. C. (For primary document see N77-17263 08-31)
Avail: NTIS HC A11/MF A01 CSCL 20F

N77-17279*# Cincinnati Univ., Ohio. Solid State Electronics Lab.
LINEAR CHARGE COUPLED DEVICE DETECTOR ARRAY FOR IMAGING LIGHT PROPAGATING IN AN INTEGRATED THIN-FILM OPTICAL WAVEGUIDE
C. L. Chen and J. T. Boyd *In* JPL Conf. on Charge-Coupled Device Technol. and Appls 1976 p 120-125 refs Prepared for Rockwell Intern. Corp., El Segundo (For primary document see N77-17263 08-31)
(Grant AF-AFOSR-3032-76)
Avail: NTIS HC A11/MF A01 CSCL 20F

N77-17293# Osaka Univ. (Japan). Dept. of Applied Physics.
EFFECT OF SCANNING APERTURE ON THE IMAGE QUALITY OF IMAGE SCANNING SYSTEM: EXPERIMENTAL RESULTS
Tatsuro Suzuki and Youichiro Suzuki *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 381-388 refs (For primary document see N77-17291 08-31)
(Rept-1309) Avail: NTIS HC A10/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-17849 North Carolina State Univ., Raleigh.
MAGNETOHYDRODYNAMIC WAVE PROPAGATION IN A CYLINDRICAL MAGNETOPLASMA Ph.D. Thesis
William Hsing-min Lee 1976 72 p
Avail: Univ. Microfilms Order No. 76-28497

A direct cylindrical wave solution is obtained to the vector-dyadic equation describing wave propagation in a two-dimensional plasma. The results are then applied to the magnetosphere, which is treated as an infinitely long cylindrical plasma immersed in a uniform azimuthal magnetic field. The effects of this investigation are analyzed both mathematically and physically, and the two-dimensional cylindrical Alfven mode is then compared to the usual plane-wave solution.
Dissert. Abstr.

N77-17850*# Kanner (Leo) Associates, Redwood City, Calif.
CALCULATION OF THE MAGNETIC FIELD, MAGNETIC FORCES AND BEHAVIOR OF LARGE COIL SYSTEMS FOR FUSION EXPERIMENTS
H. Preis Washington NASA Feb. 1977 98 p refs Transl. into ENGLISH of the report IPP III/24, Max-Plank-Institut fuer Plasmaphysik, Garching bei Muenchen, Apr. 1976 106 p
(Contract NASw-2790)
(NASA-TT-F-17382) Avail: NTIS HC A05/MF A01 CSCL 20I

Calculation methods for use in the designing of large field coil assemblies for Tokamak type fusion experiments are described. In these methods the winding form of the coil is approximated by a large number of infinitely thin conducting filaments, thereby facilitating the calculation of field parameters and the mapping of field lines. The calculations are coded as a unified set of FORTRAN programs with an error less than 1%. The behavior of the toroidal system in case of a coil short is also analyzed; it is shown how the resultant forces exerted on the field coils can be reduced by circuit modification. Author

N77-17851*# North Carolina State Univ., Raleigh.
ANALYSIS OF PLASMAS GENERATED BY FISSION FRAGMENTS
Jerry E. Deese and H. A. Hassan Washington NASA Jan. 1977 52 p refs
(Grant NsG-1058)
(NASA-CR-2776) Avail: NTIS HC A04/MF A01 CSCL 20I

A kinetic model is developed for a plasma generated by fission fragments and the results are employed to study helium plasma generated in a tube coated with fissionable material. Because both the heavy particles and electrons play important roles in creating the plasma, their effects are considered simultaneously. The calculations are carried out for a range of neutron fluxes and pressures. In general, the predictions of the theory are in good agreement with available intensity measurements. Moreover, the theory predicts the experimentally measured inversions. However, the calculated gain coefficients are such that lasing is not expected to take place in a helium plasma generated by fission fragments. The effects of an externally applied electric field are also considered. Author

N77-17852*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ESTIMATES OF OPTIMAL GENERATING CONDITIONS FOR HYDROGEN-OXYGEN CESIUM-SEEDED MAGNETO-HYDRODYNAMIC POWER GENERATOR
J. Marlin Smith and Lester D. Nichols Washington Feb. 1977 37 p refs
(NASA-TN-D-8374; E-8828) Avail: NTIS HC A03/MF A01 CSCL 20I

The value of percent seed, oxygen to fuel ratio, combustion pressure, Mach number, and magnetic field strength which maximize either the electrical conductivity or power density at the entrance of an MHD power generator was obtained. The working fluid is the combustion product of H2 and O2 seeded with CsOH. The ideal theoretical segmented Faraday generator along with an empirical form found from correlating the data of many experimenters working with generators of different sizes, electrode configurations, and working fluids, are investigated. The conductivity and power densities optimize at a seed fraction of 3.5 mole percent and an oxygen to hydrogen weight ratio of 7.5. The optimum values of combustion pressure and Mach number depend on the operating magnetic field strength. Author

N77-17853*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTRON DYNAMICS IN A PLASMA FOCUS
Frank Hohl, S. Peter Gary (Coll. of William and Mary, Williamsburg, Va.), and Patricia A. Winters Washington Feb. 1977 37 p refs
(NASA-TN-D-8356; L-11125) Avail: NTIS HC A03/MF A01 CSCL 20I

Results are presented of a numerical integration of the three-dimensional relativistic equations of motion of electrons subject to given electric and magnetic fields deduced from experiments. Fields due to two different models are investigated. For the first model, the fields are those due to a circular distribution of axial current filaments. As the current filaments collapse toward the axis, large azimuthal magnetic and axial electric fields are induced. These fields effectively heat the electrons to a temperature of approximately 8 keV and accelerate electrons within the radius of the filaments to high axial velocities. Similar results are obtained for the current-reduction phase of focus formation. For the second model, the fields are those due to a uniform current distribution. Both the current-reduction and the compression phases were studied. These is little heating or acceleration of electrons during the compression phase because the electrons are tied to the magnetic field. However, during the current-reduction phase, electrons near the axis are accelerated toward the center electrode and reach energies of 100 keV. A criterion is obtained which limits the runaway electron current to about 400 A. Author

N77-17854# Los Alamos Scientific Lab., N.Mex.
VACUUM ULTRAVIOLET EMISSION FROM ARGON, KRYPTON, AND XENON IN A RADIAL-VIEWED THETA PINCH
R. Engleman, Jr., D. B. Thomson, and D. A. Monaghan Mar. 1976 7 p refs
(Contract W-7405-eng-36)
(LA-6275-MS) Avail: NTIS HC A02/MF A01

Vacuum ultraviolet line emission from argon, krypton, and xenon (5 percent in deuterium) was observed from a plasma (approximately 50 eV and N/sub e/ approximately 10 to the 17th power/cu cm cubed) produced by the Scyllar linear theta-pinch device. More than 50 emission lines in the 30- to 500-A region have been measured for each gas mixture. Some lines were identified as due to Ar VII through XI, Kr IX and X, and Xe IX, but many lines remain unassigned. ERA

N77-17855# Los Alamos Scientific Lab., N.Mex.
MEASUREMENT OF POTENTIAL DISTRIBUTION AND

CATHODE FALL IN ELECTRON-BEAM-SUSTAINED DISCHARGES

J. T. Ganley, W. T. Leland, B. F. Bentley, and A. J. Thomas 1976 6 p Presented at the IEEE Conf. on Plasma Science, Austin, Texas, 24-26 May 1976
(Contract W-7405-eng-36)
(LA-UR-76-1123; Conf-760546-1) Avail: NTIS HC A02/MF A01

During a single discharge pulse, the plasma potential was measured at five different points, and such a plot is shown. The linear variation of plasma potential with distance across the discharge is a characteristic of all the discharges studied, regardless of the gas mix, applied field, or current density. The plasma potential distribution was extrapolated back to the cathode and the resulting intercept was interpreted as the cathode fall. The cathode fall was measured in this manner for a number of gases, for a range of pressures, current densities, and applied fields. The results of the measurements are summarized. ERA

N77-17856# Los Alamos Scientific Lab., N.Mex.
REFERENCE THETA-PINCH REACTOR (RTPR) NUCLEONIC DESIGN SENSITIVITY ANALYSIS BY PERTURBATION THEORY

E. L. Simmons (Howard Univ.), D. J. Dudziak, and S. A. W. Gerstl Mar. 1976 24 p refs
(Contract W-7405-eng-36)
(LA-6272-MS) Avail: NTIS HC A02/MF A01

The validity of 25-group cross section data, along with perturbation theory were verified to facilitate nucleonic calculations for reactions such as tritium breeding, energy deposition and atomic displacement. The effects on these responses due to variations in the Be thickness, choices of Mo, V, or Nb structural material, BeO vs Be, graphite thickness, and 6Li enrichment were investigated. Perturbation theory results for tritium breeding were accurate to within 0.6 percent for the entire range of Be thickness variations. BeO was found not to be a viable neutron multiplier in the present design of the RTPR due to the moderation of neutrons by the oxygen. Perturbation theory was accurate to within 0.3 Percent for BeO and is found invalid for graphite thickness changes greater than approximately 1.0 cm. ERA

N77-17857# Princeton Univ., N.J. Plasma Physics Lab.
ALUMINUM LIMITER EXPERIMENT IN ST TOKAMAK

E. B. Meservey, N. Bretz, D. L. Dimock, and E. Hinnov Jan. 1976 22 p refs
(Contract E(11-1)-3073)
(MATT-1203) Avail: NTIS HC A02/MF A01

In order to investigate the effects of a light-element limiter on plasma parameters, aluminum rail limiters interchangeable with Mo rails were installed top, bottom, and outside directions in the ST Tokamak. Compared with discharges produced immediately before and after with the usual Mo limiters, the 'aluminum' discharges showed an increase of T/sub e/ (by factors of 1.4-2 near the center) and of energy confinement (by factors of 2 to 3 in el. energy/power input, depending on time of observation). H2 and He discharges showed practically identical effects. In plasma composition, the Mo concentration dropped significantly, but Fe only slightly if at all; the Al concentration was about 3-5 percent (i.e., large compared to the heavier metals), whereas oxygen, about 4-8 percent to start with, dropped to insignificance, probably as a result of Al evaporation. The z/sub eff/ from resistivity increased 20-30 percent although the resistance dropped because of the higher T/sub e/. ERA

N77-17858# Princeton Univ., N.J. Plasma Physics Lab.
ENERGY SYSTEM FOR THE GENERATION OF DIVERTOR MAGNETIC FIELDS IN THE PDX FUSION RESEARCH DEVICE

N. M. Turitzin May 1976 18 p refs Presented at 6th Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 18-21 Nov. 1975
(Contract E(11-1)-3073)
(MATT-1238) Avail: NTIS HC A02/MF A01

One of the major problems encountered in the development of Tokamak type fusion reactors is the presence of impurities in the plasma. The PDX device is designed to study the operation of poloidal magnetic field divertors and consequent magnetic limiters for controlling and reducing the amount of impurities. A system of coils placed at specific locations produces a required field configuration for the poloidal divertor. The system of energy supplies required is described, as well as the interrelations of field coil currents during plasma current initiation, growth and steady state. ERA

N77-17859# Princeton Univ., N.J. Plasma Physics Lab.
NONLINEAR SATURATION OF THE DISSIPATIVE TRAPPED-ION MODE BY MODE COUPLING

Bruce I. Cohen, John A. Krommes, W. M. Tang, and Marshall N. Rosenbluth Jun. 1976 71 p refs
(Contracts E(11-1)-3073; E(11-1)-3237)
(MATT-1259) Avail: NTIS HC A04/MF A01

The basic mechanism considered is the process whereby energy in long wave-length unstable modes is nonlinearly coupled via E x B convection to short wavelength modes stabilized by Landau damping due to both circulating and trapped ions. In the usual limit of the mode frequency, small relative to the effective electron collision frequency, a one-dimensional nonlinear partial differential equation for the potential can be derived. The stability and accessibility of the possible equilibria for this equation are examined in detail, both analytically and numerically. A class of nonlinear saturated states which are stable to linear perturbations is found. Included in the analysis are the effects of both ion collisions and dispersion due to finite ion banana-width effects. Cross-field transport is estimated and the scaling of the results is considered for Tokamak parameters. It is concluded that the anomalous cross-field transport can be much lower for relevant parameters. ERA

N77-17860# Princeton Univ., N.J. Plasma Physics Lab.
PHASE CONTROLLED RECTIFIER STUDY

G. Bronner and J. G. Murray Mar. 1976 16 p refs Presented at the 6th IEEE Symp. on Engineering Problems of Fusion Research, San Diego, Calif., 18-21 Nov. 1975
(Contract E(11-1)-3073)
(MATT-1194; Conf-751125-143) Avail: NTIS HC A02/MF A01

This report introduces the results of an engineering study incorporating a computer program to determine the transient and steady-state voltage and current wave shapes for a 12-pulse rectifier system. Generally, rectifier engineering studies are completed by making simplified assumptions and neglecting many circuit parameters. The studies incorporate the 3-phase ac parameters including nonlinear source or generator, 3-winding transformer impedances, and shunt and series capacitors. It includes firing angle control, and dc filter circuits with inductive loads. ERA

N77-17861# Princeton Univ., N.J. Plasma Physics Lab.
MOLTEN SALT BLANKET CALCULATIONS FOR A TOKAMAK FUSION-FISSION HYBRID REACTOR

D. L. Chapin Apr. 1976 33 p refs
(Contract E(11-1)-3073)
(MATT-1236) Avail: NTIS HC A03/MF A01

Several possible blanket designs for use in a tokamak fusion-fission hybrid reactor are investigated. The main constituent of the blanket is a molten salt, possible with a separate convertor region for multiplication of the source neutrons. Both the thorium and uranium fuel cycles are analyzed subject to constraints on the blanket performance such as high blanket energy multiplication and sufficient breeding of tritium and fissile fuel. It is found that the behavior depends strongly on the salt composition through the ratios of fertile material to fissile material and lithium to fissile material. It is also very important to have multiplication of the high energy source neutrons in a convertor zone between the plasma and the salt. Ways of optimizing this neutron multiplication through variations in the convertor zone composition and thickness are investigated. ERA

N77-17862# Princeton Univ., N.J. Plasma Physics Lab.
POSSIBLE FUSION REACTOR

Shoichi Yoshikawa May 1976 12 p refs
(Contract E(11-1)-3073)
(MATT-1253) Avail: NTIS HC A02/MF A01

A scheme to improve performance characteristics of a Tokamak type fusion reactor is proposed. Basically, the Tokamak type plasma could be moved around so that the plasma could

be heated by compression, brought to the region where the blanket surrounds the plasma, and moved so as to keep wall loading below the acceptable limit. This idea should be able to help to economize a fusion reactor. ERA

N77-17863# Princeton Univ., N.J. Plasma Physics Lab.
COMPARATIVE ANALYSIS OF A FUSION REACTOR BLANKET IN CYLINDRICAL AND TOROIDAL GEOMETRY USING MONTE CARLO
D. L. Chapin Mar. 1976 38 p refs
(Contract E(11-1)-3073)
(MATT-1234) Avail: NTIS HC A03/MF A01

The investigation consists of three phases - a one-dimensional calculation using a circular approximation to a hexagonal shaped blanket; a two-dimensional calculation of a hexagonal blanket in an infinite cylinder; and a three-dimensional calculation of the blanket in tori of aspect ratios 3 and 5. The total blanket reaction rate in the two-dimensional model is found to be in good agreement with the circular model. The toroidal calculations reveal large variations in reaction rates at different blanket locations as compared to the hexagonal cylinder model, although the total reaction rate is nearly the same for both models. ERA

N77-17864# Oak Ridge National Lab., Tenn.
PROCEDURES FOR PARAMETRIC STUDIES OF COSTS OF SUPERCONDUCTING TOROIDAL TEST ASSEMBLIES
P. B. Thompson May 1976 31 p refs
(Contract W-7405-eng-26)
(ORNL/TM-4821) Avail: NTIS HC A03/MF A01

The primary purpose was to provide reasonably simple rational formulae for obtaining approximate costs of a complete installation, focusing on the trends and sensitivities of costs to changes in various parameters such as field strength, coil size, number of coils, and current density rather than establishing absolute costs. ERA

N77-17865# Oak Ridge National Lab., Tenn.
EQUILIBRIUM, CONFINEMENT AND STABILITY OF RUNAWAY ELECTRONS IN TOKAMAKS Ph.D. Thesis - Michigan Univ., Ann Arbor
Donald Atchison Spong Mar. 1976 224 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5147) Avail: NTIS HC A10/MF A01

Some of the ramifications of the runaway population in Tokamak experiments are investigated. Consideration is given both to the normal operating regime of Tokamaks where only a small fraction of high energy runaways are present and to the strong runaway regime where runaways are thought to carry a significant portion of the toroidal current. In particular, the areas to be examined are the modeling of strong runaway discharges, single particle orbit characteristics of runaways, macroscopic beam-plasma equilibria, and stability against kink modes. A simple one-dimensional, time-dependent model has been constructed in relation to strong runaway discharges. ERA

N77-17866# Oak Ridge National Lab., Tenn. Thermonuclear Div.
DISSIPATIVE TRAPPED ELECTRON MODES IN THE PRESENCE OF IMPURITIES
K. T. Tsang May 1976 21 p refs Submitted for publication
(Contract W-7405-eng-26)
(ORNL/TM-5287) Avail: NTIS HC A02/MF A01

The effect of impurities on low frequency drift modes of a toroidally-confined plasma was investigated by the gyro-kinetic equation. It was assumed that electrons were in the banana regime and ions in the plateau regime. Impurity collision damping was found to be significant in the usual trapped electron mode. A new instability due to the impurities occurred for normal profiles and impurities peaked at the center. Quasi-linear considerations show that impurities were driven outward when such an instability occurred. ERA

N77-17867# Oak Ridge National Lab., Tenn. Thermonuclear Div.
KINETIC EQUATIONS FOR THE COLLISIONAL PLASMA MODEL
W. I. VanRij, H. K. Meier, C. O. Beasley, Jr., and J. E. McCune (MIT) Mar. 1976 34 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5316) Avail: NTIS HC A03/MF A01

Using the Collisional Plasma Model (CPM) representation, expressions are derived for the Vlasov operator, both in its general form and in the drift kinetic approximation following the recursive derivation by Hazeltine. The expressions for the operators give easily calculated couplings between neighboring components of the CPM representation. Expressions for various macroscopic observables in the drift kinetic approximation are also given. ERA

N77-17868# Oak Ridge National Lab., Tenn. Thermonuclear Div.
CONSIDERATIONS OF COIL PROTECTION AND ELECTRICAL CONNECTION SCHEMES IN LARGE SUPERCONDUCTING TOROIDAL MAGNET SYSTEM
H. T. Yeh Mar. 1976 30 p refs
(ORNL/TM-5043) Avail: NTIS HC A03/MF A01

A preliminary comparison of several different coil protection and electrical connection schemes for large superconducting toroidal magnet systems (STMS) is carried out. The tentative recommendation is to rely on external dump resistors for coil protection and to connect the coils in the toroidal magnet in several parallel loops (e.g., every fourth coil is connected into a single series loop). For the fault condition when a single coil quenches, it is suggested that the quenched coil be isolated from its loop by switching devices, and the magnet as a whole be discharged if more than a few coils are quenched. ERA

N77-17869# Oak Ridge National Lab., Tenn. Thermonuclear Div.
EFFECTS OF THE POLOIDAL VARIATION OF THE MAGNETIC FIELD RIPPLE ON ENHANCED HEAT TRANSPORT IN TOKAMAKS
N. A. Uckan, K. T. Tsang, and J. D. Callen Jun. 1976 30 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5438) Avail: NTIS HC A03/MF A01

The use of a finite number of coils to generate the toroidal field of a Tokamak introduced a magnetic field asymmetry and was responsible for an additional particle trapping that affected the plasma confinement. The enhanced transport coefficients associated with the ripple-induced drifts were calculated. The calculations include both the radial and poloidal variation in the magnitude of the field ripple. The consideration of poloidal variation significantly reduced the ripple-trapped transport but did not affect the banana-drift diffusion. Results relevant to the ORNL Experimental Power Reactor (EPR) reference design were discussed. ERA

N77-17870# Oak Ridge National Lab., Tenn. Thermonuclear Div.
TFTR NEUTRAL BEAM SYSTEMS CONCEPTUAL DESIGN
Mar. 1976 188 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5227) Avail: NTIS HC A09/MF A01

The functions, design requirements, and design descriptions of the injection system are described. Cost summaries are given for each system and subsystem. The costs presented are for: materials procurement; and shipping, assembly, and installation. ERA

N77-17871# Los Alamos Scientific Lab., N.Mex.
STRUCTURAL DESIGN ASPECTS OF MAGNETIC COILS FOR A LINEAR THETA-PINCH HYBRID REACTOR
R. J. Bartholomew Feb. 1976 18 p refs
(Contract W-7405-eng-36)
(LA-6256-MS) Avail: NTIS HC A02/MF A01

The structural model is represented by the theory of elasticity solution to a thick-walled cylinder. Dynamic amplification (or attenuation) is considered by a shock spectrum technique. A composite material is postulated, where the conductor material for each strand is clad with a high-strength stainless steel with insulation considered. Yield strength (for isolated-pulse operation) and endurance limit (for repetitive-pulse operation) for the high-strength steel impose magnetic field strength constraints on the coil design. These constraints are combined in an overall

energy balance calculation that includes neutronic considerations to determine an optimum design. ERA

N77-17872# Energy Research and Development Administration, Washington, D.C.
ASSESSMENT OF THE ROLE OF MAGNETIC MIRROR DEVICES IN FUSION POWER DEVELOPMENT
Apr. 1976 21 p refs
(ERDA-76-74) Avail: NTIS HC A02/MF A01

An assessment of recent progress in the open systems (magnetic mirror) program is presented that considers the general question of which roles the mirror program should play in the national fusion effort. The panel conclusions, planning, and present status of mirror research are also presented. ERA

N77-17873# Argonne National Lab., Ill.
TOKAMAK ENGINEERING TECHNOLOGY FACILITY SCOPING STUDY
W. M. Stacey, Jr., M. A. Abdou, C. C. Bolta, J. A. Fasolo, R. L. Kustom, V. A. Maroni, R. F. Mattas, F. E. Mills, B. Misra, and J. S. Moenich Mar. 1976 190 p refs
(Contract W-31-109-eng-38)
(ANL/CTR-76-1) Avail: NTIS HC A09/MF A01

A scoping study for a Tokamak Engineering Technology Facility (TETF) is presented. The TETF is a tokamak with R = 3 m and I/sub p/ = 1.4 MA based on the counterstreaming-ion torus mode of operation. The primary purpose of TETF is to demonstrate fusion technologies for the experimental power reactor (EPR), but it will also serve as an engineering and radiation test facility. TETF has several technological systems (e.g., superconducting toroidal-field coil, tritium fuel cycle, impurity control, first wall) that are prototypical of EPR. ERA

N77-17874# Princeton Univ., N.J. Plasma Physics Lab.
LIMITATION OF PRESSURE OF TOKAMAK PLASMAS
S. Yoshikawa Jun. 1976 6 p refs
(Contract E(11-1)-3073)
(MATT-1261) Avail: NTIS HC A02/MF A01

With the previously obtained equilibrium solution for arbitrary plasma pressure distribution in toroidal geometry, it is shown that the plasma pressure is limited within the assumption of large aspect ratio expansion. ERA

N77-17875# Princeton Univ., N.J. Plasma Physics Lab.
LARGE ENERGY TRANSFER REACTIONS IN ION SLOWING-DOWN PROBLEMS: THEIR EFFECT ON PLASMA PROPERTIES AND A MULTIGROUP METHOD TO TAKE THEM INTO ACCOUNT
E. Greenspan May 1976 69 p refs Talk presented at Princeton Univ., N.J., 17 Jul. 1975
(Contract E(11-1)-3073)
(MATT-1235) Avail: NTIS HC A04/MF A01

Effects of nuclear elastic scattering and large angle ion-ion Coulomb interactions causing large energy transfers from energetic ions slowing down in plasmas to the plasma ions are examined. The effects examined are the fusion probability, the slowing down time and the fraction of the ion energy imparted to the plasma ions and electrons. A new multigroup method for the the solution of the ion slowing-down equation that can accurately take into account large energy transfer reactions is described. ERA

N77-17876# Princeton Univ., N.J. Plasma Physics Lab.
INTEGRATION OF THE THREE-DIMENSIONAL VLASOV EQUATION FOR A MAGNETIZED PLASMA
C. Z. Cheng Apr. 1976 19 p refs
(Contract E(11-1)-3073)
(MATT-1244) Avail: NTIS HC A02/MF A01

A second order splitting scheme is developed to integrate the three dimensional Vlasov equation for a plasma in a magnetic field. The integration of the Vlasov equation is divided into a series of intermediate steps and Fourier interpolation with a third order Taylor expansion are used to integrate the fractional equations. Numerical experiments related to cyclotron waves in 2 and 2 1/2 D are demonstrated with high accuracy and efficiency. The computer storage requirements are modest. ERA

N77-17877# Oak Ridge National Lab., Tenn. Thermonuclear Div.
TECHNIQUES FOR COMPUTING THE NUMERICAL VALUES OF THE MATRIX ELEMENTS OF THE COLLISION OPERATOR IN THE COLLISIONAL PLASMA MODEL
H. K. Meier, W. I. VanRij, and C. O. Beasley, Jr. Mar. 1976 35 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5315) Avail: NTIS HC A03/MF A01

Practical techniques for obtaining the numerical values of the matrix elements are described, for those who must implement or understand a computer simulation based on the CPM (Collisional Plasma Model). ERA

N77-17878# Oak Ridge National Lab., Tenn. Thermonuclear Div.
COLLISIONAL PLASMA MODEL: A VELOCITY-SPACE ORTHOGONAL-FUNCTION REPRESENTATION FOR THE DISTRIBUTION FUNCTION OF A COLLISIONAL PLASMA
H. K. Meier, W. I. VanRij, C. O. Beasley, Jr., and J. E. McCune (MIT) Mar. 1976 39 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5314) Avail: NTIS HC A03/MF A01

A velocity space orthogonal function representation was developed for the distribution function of a collisional plasma. The choice of functions is determined by several criteria: (1) the functions must provide an accurate representation of the Coulomb collision operator; (2) the representation must be efficient in that physical plasmas be represented by as few terms as possible in order to minimize both computer time and storage requirements; and (3) the collision and Vlasov operators must lead to simple expressions which are rapidly and easily calculated. The collision operator in the representation used is developed both for the nonlinear (general distribution functions) and approximately linear (approximately Maxwellian distribution functions) cases. Some numerical results are discussed. Expressions for macroscopic observables in terms of the expansion amplitudes are also given. ERA

N77-17879# Columbia Univ., New York. Plasma Lab.
PHYSICS OF A FUSION PLASMA BOUNDARY LAYER Ph.D. Thesis
Betty Jensen 1976 162 p refs
(Contracts E(11-1)-2456; F44620-71-C-0010)
(COO-2456-30; Rept-67) Avail: NTIS HC A08/MF A01

The effects caused by thermal conduction, plasma convection, magnetohydrodynamic phenomena, atomic recombination and ionization, diffusion of neutral atoms which are formed near the wall, and radiation are studied. The time evolution of the plasma temperature, pressure, the charged and neutral particle concentrations, magnetic and electric field strengths, and the plasma current density in the neighborhood of the solid surface are investigated. The rate of energy transfer from the plasma to the wall is calculated, and the conditions under which wall surface melting occurs are estimated. ERA

N77-17880# Energy Research and Development Administration, Washington, D.C. Div. of Controlled Thermonuclear Research.
REVIEW OF VACUUM TECHNOLOGY FOR CONTROLLED THERMONUCLEAR RESEARCH Summary Report, 21-22 Jan. 1976
H. S. Cullingford Mar. 1976 130 p refs
(ERDA-76-62) Avail: NTIS HC A07/MF A01

The Tokamak, mirror, and theta-pinch concepts of the magnetically confined fusion program are discussed with emphasis on vacuum technology and its development for controlled thermonuclear research. ERA

N77-17881# California Univ., Livermore. Lawrence Livermore Lab.
ESTIMATION OF THE ADIABATIC ENERGY LIMIT VERSUS BETA IN BASEBALL II
James H. Foote 1 Jun. 1976 33 p refs
(Contract W-7405-eng-48)
(UCID-17153) Avail: NTIS HC A03/MF A01

Several estimates of the adiabatic energy limit versus beta are summarized, and the calculational methods used to obtain them are described. Some estimates are based on analytic expressions; for others, particle orbits are calculated, magnetic-moment jumps are inspected, and adiabatic limits then derived.

The results are sensitive to the assumed variation of the combined vacuum-plus-plasma magnetic field. The calculated adiabatic energy limit falls rapidly with beta, even for a gradual magnetic field variation. If we assume a sharp depression in the axial profile of the combined magnetic field for a finite beta plasma, the adiabatic limit can be further markedly reduced. ERA

N77-17882# Columbia Univ., New York. Plasma Lab.
PLASMA IMPURITY STUDY USING INFRARED AND OPTICAL EMISSION ANALYSIS Ph.D. Thesis
Louis S. Scaturro 1976 108 p refs
(Contract E(11-1)-2456)
(COO-2456-31; Rept-68) Avail: NTIS HC A06/MF A01

Measurements of the effective Z of a plasma produced in a coaxial electromagnetic shock tube were made in both deuterium and helium gas. A fast Ge:In photodetector was used to measure the total infrared emission spectrum and a laser interferometer to simultaneously measure electron density. In helium, electron temperatures were measured by line emission intensity ratios; Thomson scattering was used to measure T sub e in deuterium. After extensive discharge cleaning (approximately 100 shots) the emission from the plasma was found to agree with the standard theory of bremsstrahlung. ERA

N77-17883# Energy Research and Development Administration, Washington, D.C. Div. of Controlled Thermonuclear Research.
NEUTRAL BEAM ENERGY AND POWER REQUIREMENTS FOR THE NEXT GENERATION OF TOKAMAKS
J. W. Willis, A. M. Sleeper, D. W. Ignat, and P. M. Stone 1976 35 p refs
(ERDA-76-77) Avail: NTIS HC A03/MF A01

In particular, the following questions are examined: how these requirements are determined, what critical assumptions are being made, how the requirements for the various machines compare, and what the overall cost of such systems is likely to be. ERA

N77-17884# Oak Ridge National Lab., Tenn.
HIGH POWER ELECTRON CYCLOTRON HEATING IN ISX AND ORMAK UPGRADE AT ORNL
A. C. England, O. C. Eldridge, F. B. Marcus, J. C. Sprott, W. Namkung, and J. B. Wilgen May 1976 37 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5425) Avail: NTIS HC A03/MF A01

A phased program of plasma heating at the electron cyclotron frequency is proposed. The physics of wave propagation and particle heating are fairly well understood and indicate the viability of this technique. Studies on breakdown and on runaway electron reduction will provide useful information for larger machines. Recent experiments in the U.S.S.R. on small Tokamaks have shown that electron cyclotron heating is a viable heating technique. Providing that the microwave tubes become available, the engineering considerations suggest that the technique is practical and workable, based on present day technology. ERA

N77-17885# Princeton Univ., N.J. Plasma Physics. Lab.
CARBON INFLUX FLOW RATE IN AN OHMICALLY HEATED PLASMA IN THE FM-1 SPHERATOR
K. Ando, M. Okabayashi, S. Suckewer, V. Arunasalam, R. J. Hawryluk, and J. Wilson May 1976 26 p refs
(Contract E(11-1)-3073)
(MATT-1250) Avail: NTIS HC A03/MF A01

The flow rate of neutral carbon atoms during the initial startup phase of an ohmically heated plasma in the FM-1 spherator was determined from the spatially resolved measurements of the carbon line radiation and independent measurements of spatial distribution of plasma density and electron temperature. This was accomplished by comparing the measured carbon line intensity with a numerical solution of time-dependent coupled differential rate equations for several carbon ionization states. ERA

N77-17886# Princeton Univ., N.J. Plasma Physics Lab.
PARAMETRIC DECAY OF KINETIC ALFVEN WAVE AND ITS APPLICATION TO PLASMA HEATING
Akira Hasegawa and L. Chen Mar. 1976 14 p refs
(Contract E(11-1)-3073)
(MATT-1232) Avail: NTIS HC A02/MF A01

Because of its electrostatic properties, the rate of the parametric growth of the kinetic Alfven wave (Alfven wave with lambda identical with sq k/sub perpendicular/sq c/sub s/sq omega/sub ci/ approximately O(1) is shown to be larger than that of the classic result by a factor of lambda omega/sub ci/omega/sub A/ where omega/sub ci/, omega sub A/ are the ion cyclotron and the Alfven frequencies, K/sub perpendicular/ is the perpendicular wave number and c/sub s/ is the ion sound speed. This fact can be utilized to heat a plasma with a Tokamak-type parameter. ERA

N77-17887# Princeton Univ., N.J. Plasma Physics Lab.
HIGHLY IONIZED ATOMS IN TOKAMAK DISCHARGES
E. Hinnov May 1976 30 p refs
(Contract E(11-1)-3073)
(MATT-1240) Avail: NTIS HC A03/MF A01

Tokamak discharges are characterized by electron densities usually approximately 0.3 to 10 to the 14th power/cu cm and temperature from a few hundred eV to several keV. In addition to the working gas (H or He), the plasma normally contains some light impurities that are completely stripped except at the outer periphery, and heavier elements from the vacuum wall and current-aperture limiter that remain partly stripped, hence relatively strongly radiating, throughout the discharge. Other elements, especially noble gases, may be deliberately added for diagnostic purposes. Resonance lines fo Fe and Ar in the beryllium and lithium sequences, of Fe, Kr, and Mo in the magnesium and sodium sequences, and of Mo and Xe in the zinc and copper sequences were used for rough determination of plasma composition. ERA

N77-17888# Princeton Univ., N.J. Plasma Physics Lab.
OBSERVATION OF INVERTED POPULATION LEVELS IN THE FM-1 SPHERATOR
S. Suckewer, R. J. Hawryluk, M. Okabayashi, and J. A. Schmidt Apr. 1976 13 p refs
(Contract E(11-1)-3073)
(MATT-1241) Avail: NTIS HC A02/MF A01

Inversions in the populations of excited levels in hydrogen and He2 were observed in the FM-1 Spherator. The inversion increases strongly as the ratio of the decay time of the electron temperature to the decay time of the electron density was decreased. Time dependent numerical calculations of the populations were in good agreement with the experimental measurements. More general calculations for high Z hydrogen-like ions are discussed. ERA

N77-17889# Wisconsin Univ., Madison.
MAGNETICALLY PERTURBED PLASMA CONFINEMENT IN A TOROIDAL OCTUPOLE INCLUDING OBSTACLE INFLUENCE
J. R. Drake and J. R. Greenwood 1976 35 p refs Sponsored by ERDA
(COO-2387-39) Avail: NTIS HC A03/MF A01

Permanent-magnet dipole perturbations were positioned outside the external conducting wall of a pulsed, shearless toroidal octupole plasma containment device. Floating potential profiles and losses were studied for two perturbation configurations: field lines were either closed within the plasma containment zone or were drawn outside the containment zone. Profiles were not affected by the former configuration but were altered when the field lines were drawn outside the containment zone. The extent of the profile change was enhanced when the azimuthal anti E x anti B drifts were suppressed by the presence of obstacle-like internal ring supports. With the anti E x anti B drifts suppressed, the incidence of repetitive encounters was increased between transit particles following field lines and the perturbation field. The net result was particle trajectory displacement and altered V/sub f/profiles. ERA

N77-17890# California Univ., Livermore. Lawrence Livermore Lab.
SOME EFFECTS OF MAGNETIC WALLS ON THE TRANSVERSE MOTION OF AN INTENSE BEAM OF CHARGED PARTICLES
V. K. Neil 1 Apr. 1976 11 p refs Sponsored in part by the Dept. of the Navy
(Contract W-7405-eng-48)

(UCID-17108) Avail: NTIS HC A02/MF A02

The focusing properties of a magnetic medium surrounding a beam of relativistic particles were examined. The magnitude of the magnetic forces generated by the wall is proportional to the beam current. For a current of the order of 10 kA, significant magnetic field gradients are obtained. It was concluded that the series of structures studied is not satisfactory for providing focusing of an intense beam of particles. However, the characteristics of the transverse forces suggest a method of constructing a passive, current-dependent, deflector for an intense beam. ERA

N77-17891# Battelle Pacific Northwest Labs., Richland, Wash.
FUSION ENERGY OPTION
L. C. Schmid [1976] 27 p refs
(Contract E(45-1)-1830)
(BNWL-SA-5802) Avail: NTIS HC A03/MF A01

The potential of fusion energy contributing to the energy needs is discussed. Once feasibility questions are answered and engineering problems are resolved, it should be possible to produce energy in a form that can use current methods of electrical generation to convert it into a useful form. If the fusion system is operated with only deuterium as fuel, the deuterium available from a pail of water would produce energy equivalent to that produced by 600 gallons of gasoline. The water in the ocean could provide energy for billions of years at the current rate of consumption. Experimental results are currently confirming the theoretical predictions and the schedule for fusion development is shown to be completion of feasibility experiments in 1974; physics test reactors appearing in 1983; experimental power reactors being built in 1990; and the demonstration plant on-line in 1994. The process of producing fusion power, fusion research needs, and problems to be solved are reviewed. ERA

N77-17892# Los Alamos Scientific Lab., N.Mex.
ENERGY STORAGE AND TRANSFER WITH HOMOPOLAR MACHINE FOR A LINEAR THETA-PINCH HYBRID REACTOR
H. F. Vogel, M. Brennan, W. G. Dase, K. M. Tolk, and W. F. Weldon Dec. 1975 28 p refs
(Contract W-7405-eng-36)
(LA-61-74) Avail: NTIS HC A03/MF A01

The energy storage and transfer system for the compression coil system of a linear theta-pinch hybrid reactor (LTPHR) is described. High efficiency and low cost are the principal requirements for the energy storage and transfer of 25 MJ/m or 25 GJ for a 1-km LTPHR. The circuit efficiency must be approximately 90 percent, and the cost for the circuit 5 to 6 cents/J. Scaling laws and simple relationships between circuit efficiency and cost per unit energy as a function of the half cycle time are presented. Capacitors and homopolar machines are considered as energy storage elements with both functioning basically as capacitors. The advantage of the homopolar machine in this application is its relatively low cost, whereas that of capacitors is better efficiency. ERA

N77-17893# Maryland Univ., College Park.
PRODUCTION AND ANALYSIS OF THERMONUCLEAR PLASMAS IN HIGH BETA DEVICES Progress Report
1976 42 p refs
(Contract E(40-1)-4514)
(ORO-4514-3) Avail: NTIS HC A03/MF A01

During the October 1975-July 1976 reporting period, significant progress was reported in all ongoing projects funded by ERDA. Construction of the major new experiment THOR was delayed due to difficulties in bringing the Maxwell Laboratory swinging LC-pulse generators up to specifications. These technical difficulties were overcome, and the pulsers were accepted late in April. TERP, originally funded as an Exploratory Concept, is now operating successfully and has given confinement physics results which are important for the development of Maximum Beta Tokamaks. The Measurement and Instrumentation efforts resulted in a number of instrument developments that were successfully tested on FTP or STP, which are fast or small theta pinches. Both FTP and STP were studied intensively to obtain ion and electron heating rates and anomalous post-implosion resistivities. These results are supported by the University of Maryland theory and simulation programs and SAI. ERA

N77-17894# Arizona Univ., Tucson.
EXPERIMENTAL VALIDATION OF TRANSIENT PLASMA EFFECTS USED IN HIGH ALTITUDE ELECTROMAGNETIC PULSE CALCULATIONS Final Report
Robert N. Carlile Kirtland AFB, N. Mex. AFWL Jun. 1976 22 p refs
(Contract F29601-75-C-0082; ILIR Proj. 75-06)
(AD-A028516; AFWL-TR-75-276) Avail: NTIS HC A02/MF A01 CSCL 20/14

The work discussed in this report concerns the propagation of an electromagnetic pulse (EMP) through the high altitude EMP source region. The objective of this work has been to obtain experimental data on the nonlinear absorption of an EMP by conduction currents within the high altitude EMP source region that could be compared with theoretical predictions. GRA

N77-17895# Air Force Geophysics Lab., Hanscom AFB, Mass.
PLASMA HEATING THROUGH PARAMETRICALLY INDUCED TURBULENCE Environmental Research Papers
Arthur L. Pavel 2 Jun. 1976 28 p refs
(AF Proj. 8600)
(AD-A030727; AFGL-TR-76-0116; AFGL-ERP-562) Avail: NTIS HC A03/MF A01 CSCL 20/9

Electromagnetic waves have been shown to be capable of significantly modifying both the magnetospheric and ionospheric plasma. Laboratory studies of the plasma instabilities generated in microwave-plasma interactions have helped to understand the geophysical experiments. Microwave-plasma research has also been useful in modeling the interaction of lasers and plasmas, particularly in relation to efforts using pulsed lasers to compress and heat plasma to thermonuclear conditions. An experiment is described which investigates the evolution of the parametric instability which occurs with near resonant matching of the microwave frequency and plasma frequency. Near threshold, a finely detailed spectrum of satellite electron plasma waves is observed. These waves break down into a turbulent plasma condition with a marked change in power absorbed by the plasma. The plasma passes through several distinctive regimes of turbulent plasma conditions. At the highest power levels used, there are plasma waves hundreds of megacycles from the driving frequency. The plasma is found to absorb a significant amount of power and heat electrons to high energies. Author (GRA)

N77-17896# Wisconsin Univ., Madison. Mathematics Research Center.
THEORY OF NONLINEAR DIFFUSION OF PLASMA ACROSS A MAGNETIC FIELD. 1: SOLUTION OF A CLASS OF QUASILINEAR PARABOLIC EQUATIONS
James G. Berryman Jun. 1976 44 p refs
(Contracts DAAG29-75-C-0024; E(11-1)-2387; Grant NSF ENG-75-08492)
(AD-A029910; MRC-TSR-1635) Avail: NTIS HC A03/MF A01 CSCL 20/9

The mathematical theory of a class of equations arising in studies of cross-field diffusion in toroidal multipole plasmas is presented. This class of quasilinear parabolic equations has a separable solution (the 'normal mode') which decays in time. It is shown that the normal mode is stable against infinitesimal perturbations; all small perturbations decay more rapidly than the normal mode. Numerical experiments show that large perturbations also decay more rapidly than the normal mode. It is demonstrated analytically that large perturbations decay exponentially whereas small perturbations decay as the fourth power (or higher) of the normal mode time dependence. Thus, the normal mode will rapidly evolve out of an initial distribution of particles, in agreement with the experiments. The asymptotic behavior of the system can be predicted approximately from knowledge of the initial particle distribution. The class of equations studied is also of interest in a variety of other physical, chemical, and engineering problems. GRA

N77-17897# Wisconsin Univ., Madison. Mathematics Research Center.
THEORY OF NONLINEAR DIFFUSION OF PLASMA ACROSS A MAGNETIC FIELD. 2: APPLICATION TO DIFFUSION STUDIES IN A TOROIDAL MULTIPOLE
J. R. Drake and James G. Berryman Jul. 1976 38 p refs
(Contracts DAAG29-75-C-0024; E(11-1)-2387; Grant

NSF ENG-75-08492)
(AD-A029966; MRC-TSR-1647) Avail: NTIS HC A03/MF A01 CSCL 20/9

The authors study a model for cross-field plasma diffusion which describes the observed density profile shape and decay in the Wisconsin levitated octupole in certain regimes. The boundary conditions of the model are zero density at the two plasma edges. The authors have shown that the observed profile, which is peaked off the separatrix and retains a constant shape as the profile decays, has the spatial and temporal dependences of the separable solution to the diffusion equation. Furthermore, according to a stability analysis of the model, perturbations decay at least four times as fast as the final stable profile; thus, the observed rapid evolution toward a stable shape is explained. The authors conclude that the model is useful for determining diffusion coefficient magnitude and scaling with density once the density profiles are known. GRA

N77-17294# Osaka Univ. (Japan). Dept. of Nuclear Engineering.
MOTION OF CHARGED PARTICLES IN AN ADIABATIC TRAP
Tomejiro Yamagishi *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 397-402 refs (For primary document see N77-17291 08-31)
(Rept-1311) Avail: NTIS HC A10/MF A01

N77-17304# Osaka Univ. (Japan). Dept. of Electrical Engineering.
HEATING OF PLASMA FOCUS BY TES CO2 LASER, 1
Aye Thein, Yoneyoshi Kitagawa, Akira Miyazaki, Hisayoshi Nakakita, Eiji Setoyama, Chobei Yamabe (NAGOYA Univ.), Masahiro Yokoyama, and Chiyoe Yamanaka (Nagoya Univ.) *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 487-798 refs (For primary document see N77-17291 08-31)
(Rept-1322) Avail: NTIS HC A10/MF A01

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N77-17898 Communications Research Centre, Ottawa (Ontario). Space Technology Branch.
THE STRUCTURE OF HCL DOPED SILICON OXIDES AND OF THE OVERLAYING METALLIZATION
M. Bouchard, W. A. Hartman, and R. M. Kuley Oct. 1976 28 p refs
(CRC-1298) Copyright. Avail: Issuing Activity

The addition of chlorine during processing improves the dielectric properties of silicon dioxide by reducing the concentration of mobile ions in the oxide. An optimum value of approximately 4 vol % HCl:02 is used because of possible detrimental effects. At higher concentrations of chlorine (e.g. 10 vol % HCl:02 mixture) the oxide surface becomes irregular and the excess chlorine forms pockets within the oxide. The oxide defects are characterized. Results show that their number, size and distribution are influenced by the chlorine concentrations, the processing sequence, the cooling rate following the oxidation, and the wafer orientation. The oxide defects also cause a local lifting of most metallizations and can cause pitting of aluminum. Author

N77-17899# Hokkaido Univ., Sapporo (Japan). Research Inst. of Applied Electricity.
MAGNETOCRYSTALLINE AND UNIAXIAL ANISOTROPY IN EPITAXIAL (110) Ni AND Ni-Fe THIN FILMS
Shinya Kuriki and Goro Matsumoto, ed. 1976 87 p refs
(Mono-23) Avail: NTIS HC A05/MF A01

Ni and Ni-Fe films were epitaxially grown on surface of a single crystal Cu substrate by both vacuum evaporation and electrodeposition. Torque measurements were carried out for those films, from which the magneto-crystalline anisotropy constants, the uniaxial anisotropy constant and the perpendicular anisotropy constant were determined. Variations of the anisotropy constants with various parameters of film deposition, i.e. film thickness, composition, evaporation rate, vacuum during the evaporation, substrate temperature, surface condition of the substrate, and solution pH, were studied. Author

N77-17900*# Kanner (Leo) Associates, Redwood City, Calif.
CRYSTAL CHEMISTRY OF TERNARY SULFUR AND SELENIUM COMPOUNDS OF LOW VALENCE MOLYBDENUM Ph.D. Thesis. Rennes Univ., France
J. Guillevic Washington NASA Feb. 1977 93 p refs Transl. into ENGLISH of the Ph.D. dissertation "Cristallochemie de composes sulfures et selenies ternaires du molybdene de basse valence", Rennes Univ. (France), 1974 p 1-104
(Contract NASw-2790)
(NASA-TT-F-17380) Avail: NTIS HC A05/MF A01 CSCL 20B

Methods for the preparation of monocrystals and the gathering and reduction of crystallographic data are described. The structures of transition element thiomolybdites, ternary selenium, and sulfur containing molybdenum phases are presented and discussed. A detailed discussion is presented of Mo3Se4 type structures, the effect of insertion on crystal structure and relations between structure and magnetic susceptibility, resistivity and superconductivity. It is concluded that superconductivity of the M sub XMo3X4 phases is connected to the insertion of large cations, which stabilize the base structure, and to the nature of the X lattice. Author

N77-17901# Lockheed Missiles and Space Co., Palo Alto, Calif.
DAMAGE MECHANISM FOR HEAT-REGULATING COATINGS DUE TO CHARGED AND MICROMETEORITE PARTICLES
G. I. Petrov, ed. [1976] 11 p refs Transl. into ENGLISH from the book "Modelirovanie Teplovykh Rezhimov Kosmicheskogo Apparata i Okruzhaiushchei Ego Sredy" Moscow, Mashinostroenie Press, 1971 p 90-101
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The influence of ionizing radiation on the solar radiation absorption coefficient and the coefficient of emissivity of the coatings of a space vehicle was investigated. It was found that various physicochemical processes, which alter the optical and other characteristics of the coatings, occur under the action of space corpuscular radiation and meteorite particles on heat-regulating materials. These processes result in a change of both of the coefficients. The causes for the change in the optical characteristics of heat-regulating coatings was determined as radiation defects in the crystal lattices, formation of coloring centers, atomization of the material and change of surface properties, and meteorite erosion of the surface. The radiation damage mechanisms are described in detail. I.M.

N77-17902# Brookhaven National Lab., Upton, N.Y.
NEW INSIGHTS ON THE THERMAL DECOMPOSITION OF AMMONIUM PERCHLORATE FROM STUDIES ON VERY LARGE SINGLE CRYSTALS
P. J. Herley (State Univ. of New York, Stony Brook) and P. W. Levy 1976 5 p refs Presented at 8th Intern. Symp. on Reactivity of Solids, Gottenburg, Sweden, 14 Jun. 1976 Sponsored by ERDA
(BNL-20881; Conf-760608-1) Avail: NTIS HC A02/MF A01

The large crystals were thermally decomposed at 227 C, either without irradiation or after irradiation in water-cooled Co-60 sources. The crystals were then examined with optical or scanning and transmission electron microscopes. Between 20,000 and 1 million R the crystals are transparent but become translucent on heating. Higher doses result in opaqueness, pitting, and voids. Retentions of 70 to 96 percent are observed with large crystals. The decomposition is surface-related, at least on the c-face, and the Avrami-Erofeyev kinetics apply only to crystals less than 0.2 and 0.3 mm. ERA

N77-17903# Brookhaven National Lab., Upton, N.Y.
INVESTIGATION OF DEEP INELASTIC PROCESSES IN O-16 + Ni AT 96 MeV
P. D. Bond, C. Chasman, and A. Z. Schwarzschild 1976 8 p refs Presented at Symp. on Macroscopic Features of Heavy Ion Collisions, Argonne, Ill., 1 Apr. 1976 Sponsored by ERDA

(BNL-21213; Conf-760424-7) Avail: NTIS HC A02/MF A01

An earlier work on oxygen-16 reactions with nickel at 96 MeV was extended in order to investigate the extent to which two body kinetics reproduce that process and to assess the possible role of light contaminants in the target for producing an apparent deep inelastic peak. Various mass spectra and differential cross sections were shown and discussed. Author (ERA)

N77-17904# California Univ., Berkeley. Lawrence Berkeley Lab.

ELECTRICAL CONDUCTIVITY IN LITHIUM FERRITE AND LEAD ZIRCONATE-TITANATE CERAMICS

Jiunn-Jye Dih Apr. 1976 104 p refs

(Contract W-7405-eng-48)

(LBL-4930) Avail: NTIS HC A06/MF A01

Electrical conduction in polycrystalline lead zirconate-titanate and lithium ferrite ceramics was investigated. The effects of temperature, impurities, defect structure, nonstoichiometry, and microstructure on the electrical conductivity were determined and compared with the existing theoretical models. It is shown that electrical conduction in lead zirconate-titanate follows typical semiconductor behavior. Holes contributed by lead vacancies are the major charge carriers. Impurity ions which serve as acceptors or donors significantly affect the conduction process. The activation energy is 3.6 eV for intrinsic conduction, 1.41 eV for extrinsic conduction due to Nb2O5 doping and 1.01 eV due to So2O3 doping. Data are presented to show the influence of stoichiometry which affects the concentration of charge carrier, and temperature which affects the mobility of charge carrier, on the dc resistivity of lithium ferrite. Author (ERA)

N77-17905# Oak Ridge National Lab., Tenn.

COMBINED EFFECTS OF DISPLACEMENT DAMAGE AND HIGH GAS CONTENT IN ALUMINUM

K. Farrell and J. T. Houston May 1976 28 p refs Presented at Intern. Conf. on Radiation Effects and Tritium Technol. for Fusion Reactors, Gatlinburg, Tenn., 1-3 Oct. 1975

(Contract W-7405-eng-26)

(ORNL/TM-5395; Conf-750989) Avail: NTIS HC A03/MF A01

A solid solution alloy of 2300 appm of Li6 isotope in aluminum was neutron irradiated at about 0.36 T/sub m/in high, fast and thermal fluxes producing a damage level of 2 to 3 dpa and simultaneously inducing a gas content of about 2200 appm each of helium and tritium from burnup of Li6. The gases significantly increased the nucleation of structural defects but did not change the degree of swelling; cavity concentrations were increased approximately 1000-fold, cavity sizes were decreased approximately 10 fold and there was approximately 10-fold increase in the concentrations of dislocations. Large cavities were developed on grain boundaries. The cavities were consistent with their being gas-filled bubbles. The refinement of damage structure by the gases caused a considerable increase in radiation hardening. Bend tests at 77 and 296 K revealed severe embrittlement and intergranular fracture. ERA

N77-17906# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

COMPUTER PROGRAM FOR THE SIMULATION OF SOLID SOLUTIONS

R. O. Williams May 1976 39 p refs

(Contract W-7405-eng-26)

(ORNL-5140) Avail: NTIS HC A03/MF A01

A computer program is described which rearranges the atoms on a lattice containing 12,075 sites until the populations in a set of 18 shells are in agreement with those calculated from X-ray measurements. Various structural features for the model are discussed and compared with the same features in the initial random model. The program is written from the face-centered cubic lattice. Author (ERA)

N77-17907# AEG-Telefunken, Heilbronn (West Germany). Fachbereich Halbleiter.

NEW DOPING AND PASSIVATION METHODS Final Report

Arno Kostka Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1976 60 p refs In GERMAN; ENGLISH summary

(Contract BMFT-NT-372)

(BMFT-FB-T-76-50) Avail: NTIS HC A04/MF A01; ZLDI, Munich, DM 12.60

The techniques of ion implantation, diffusion from doped dielectric materials, and passivation at intermediate temperatures (less than 800 C) were investigated and used for the fabrication of silicon devices. As a non-thermal process, ion implantation (B, P, Ne, Si) opens new inroads and, using state-of-the-art equipment, proves successful and advantageous, especially where low to intermediate doses of doping material must be precisely controlled (less than 2% tolerance). For diffusions from doped dielectrics (spin-on and boron-nitride techniques), the tolerances achieved center at about 5%. Silicon oxynitrides deposited from a glow-discharge, and lead-borosilicate glasses allow passivation on top of aluminum layers. Author (ESA)

N77-17908# National Bureau of Standards, Boulder, Colo.

APPLICATION OF CONTRAST TO DYNAMICAL IMAGES OF IMMOBILE DISLOCATIONS Final Report

W. J. Boettinger, H. E. Burdette, and M. Kuriyama 9 Feb. 1976 11 p refs Repr. from Phil. Mag. (England), v. 34, 1976 p 119-127

(PB-258219/5) Avail: NTIS HC A02/MF A01 CSCL 20B

Conditions of invisibility were applied to a particular pattern of straight line images observed by Borrmann disruption in thick crystals mu L>15 using many diffracting planes. It is found that the condition H.b=0 alone is sufficient to determine that the images are caused by Lomer sessile edge dislocations. Furthermore, it is found that the condition H.bxn=0 was not necessary to predict the invisibility of these images. This fact is attributed to the complexities of image formation by dynamical diffraction in imperfect crystals. Crystal discs which were carefully acid sawed and chemically polished from copper single crystals grown with a (001) seed by the Czechralski technique were used in the study. GRA

N77-17909# South Dakota School of Mines and Technology, Rapid City. Dept. of Mechanical Engineering.

TOTAL ABSORPTANCE CORRELATIONS FOR SEMITRANSPARENT SOLIDS Annual Report, Sep. 1975 - Jul. 1976

Edward E. Anderson and John D. Osnes Aug. 1976 49 p refs

(Grant NSF ENG-75-17728)

(PB-258089/2; SDSMT/MNSF-7601) Avail: NTIS HC A03/MF A01 CSCL 20L

Calculations were made of the total absorptance of lithium flouride and fused silica using a dispersion model and experimental optical properties, respectively. Least squares regression analysis gave accurate logarithmic correlations over the pathlength ranges 0.1 to 1 cm for LiF and 0.1 to 10 cm for fused silica. In general, the correlation parameters are functions of the medium's temperature. A single correlation of reduced accuracy is reported for LiF. A similar correlation could not be found for fused silica. In the nearly transparent and opaque limits, the logarithmic correlation is inaccurate for solids. Additional efforts are required to find a universal correlation. GRA

N77-17910# California Univ., Los Angeles. Dept. of Physics.

STUDY OF OPTICAL INTERACTIONS IN SOLIDS Final Report, 2 Apr. 1969 - 31 Mar. 1976

Rubin Braunstein 4 Jul. 1976 17 p refs

(Grants DA-ARO(D)-31-124-72-G1116; DA-ARO(D)-31-124-72-G131)

(AD-A028278; ARO-8174.18-P) Avail: NTIS HC A02/MF A01 CSCL 20/12

The band structures of the IV and III-IV semiconductors, the noble metals, the Pb sub (1-x) SN sub x Te alloys and the perovskites SrTiO3 and LiNbO3 were studied by optical derivative techniques. In addition, infrared cyclotron resonance measurements were performed in the conduction band in the Ge-Si alloy systems. The experimental results were correlated with existing band theories for these substances. Author (GRA)

N77-17911# California Univ., Irvine. Dept. of Physics.

THEORY OF BOUND STATES ASSOCIATED WITH n-TYPE INVERSION LAYERS ON SILICON (001) SURFACES Interim Report

B. G. Martin and R. F. Wallis (Lab. de Phys. des Solides, Paris) 1976 6 p refs

(Contract N00014-69-A-0200-9003; NR Proj. 392-001)
(AD-A028098) Avail: NTIS HC A02/MF A01 CSCL 20/12

Binding energies are calculated as functions of electric field for several electronic bound states of impurities localized at the interface between SiO2 and an n-type inversion layer on Si(001). The intensity of electron-dipole transitions and the effect of screening by free carriers are investigated. GRA

N77-17912# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
COMPUTER PROGRAMS FOR STRUCTURAL CHEMISTRY: STATUS. A FORTRAN PROGRAM FOR STATISTICAL ANALYSIS OF CRYSTALLOGRAPHIC QUANTITIES Final Report
LeRoy W. Schroeder and Brian Dickens Jan. 1976 153 p refs
(PB-257729/4; NBSIR-76-1102; NBS-DF-76/004a) Avail: NTIS HC A08/MF A01 CSCL 20B

A FORTRAN computer program was described for evaluation of: (1) the results of crystallographic least-squares refinements by examination of the residuals, (2) differences in sets of data collected by different methods from the same crystal, (3) differences in data sets collected by the same method from different crystals of the same material, and (4) the differences in parameters in different models representing the crystal structure of the same material. Part of the evaluation was accomplished by plots of residuals against the expected normal distribution quantities. Additional plots compared residuals with the independent variable and with the calculated variable. GRA

N77-17913# Naval Postgraduate School, Monterey, Calif.
ELECTROEXCITATION OF GIANT RESONANCES IN Ni 60 BETWEEN 5 MeV AND 30 MeV EXCITATION ENERGY M.S. Thesis
Dorse Howard DuBois, II and George Macnider Bates Jun. 1976 77 p refs
(AD-A028890) Avail: NTIS HC A05/MF A01 CSCL 20/8

Giant multipole resonances and bound states above 6 MeV in Ni 60 were studied with inelastic scattering of electrons at 10 MeV incident energy and scattering angles of 60, 75, 90, and 105 degrees. In the energy interval from 5 MeV to 40 MeV excitation energy, ten states and resonances were observed of which only those below 7 MeV and those at 16.5 and 18.5 had been previously reported. Reduced transition probabilities were calculated, and multipolarity assignments were made. The ten transitions were observed at excitation energies of 6.1 (Ee,E2), 7.0 (E3,M2), 7.6 (E2,E3,M2), 8.4 (E2,E0), 9.9 (E1), 11.8 (E2,E0), 12.9 (E3,M2), 15.0 (E4), 16.5 (E2,E0), and 18.5 (E1) MeV. The E4 resonance at 15.0 MeV was previously unreported. The E2 resonance at 16.5 Mev reported in (alpha, alpha primed) work and the E1 resonance at 18.5 MeV from (Gamma,n) were confirmed. Author (GRA)

N77-17914# Stanford Univ., Calif. W. W. Hansen Labs. of Physics.
APPLICATION OF QUANTUM FIELD THEORY TO SOLID STATE PROBLEMS Final Report, 3 Dec. 1969 - 31 Jul. 1975
S. Doniach 1 Jul. 1976 12 p
(Grants DA-ARO(D)-31-124-70-G41; DA-ARO(D)-31-124-73-G11)
(AD-A028279; ARO-8742.13-P) Avail: NTIS HC A02/MF A01 CSCL 20/10

In this report, work on a variety of problems involving high energy excitations in solids, instabilities of Fermion systems and phase transistions in 1 and 2 dimensional systems is summarized. A guide is given to publications produced wholly or partially with support from AROD under this grant, which are listed in the appendix. Author (GRA)

N77-17915# State Univ. of New York, Albany. Dept. of Physics.
DIFFUSION IN SEMICONDUCTORS OF GROUP 4
J. Bourgoin and J. W. Corbett Jul. 1976 32 p refs In FRENCH; ENGLISH summary Submitted for publication
(Contract N00014-75-C-0919)
(AD-A029319) Avail: NTIS HC A03/MF A01 CSCL 20/12

The quantities which theoretically and experimentally characterize diffusion are briefly reviewed and discussed. Emphasis is placed on the difficulties in reconciling theory and experiment; in particular it is noted that self-diffusion in silicon is still a matter of controversy. The different aspects of charge state effects on diffusion are discussed in detail. Author (GRA)

N77-17916# Naval Research Lab., Washington, D.C.
CALCULATIONS OF THE SUPERCONDUCTING PROPERTIES OF COMPOUNDS
Barry M. Klein, Dimitrios A. Papaconstantopoulos, and Larry L. Boyer Jul. 1976 29 p refs
(NRL Proj. P04-04; RR0110741)
(AD-A028606; NRL-MR-3323) Avail: NTIS HC A03/MF A01 CSCL 20/3

Using the results of self-consistent relativistic APW band structure calculations, and the measured phonon spectra, we have calculated the electron-phonon interaction and lamda for the compounds: PdD, NbC, TaC, HfC and V3Si, based on an extension of the theoretical formulation of Gaspari and Gyorffy. We discuss and contrast the nature of superconductivity in these different materials, and give an extended explanation of the relationship between superconductivity, phonon anomalies and chemical bonding (as mirrored in the Fermi surface) of the refractory carbides. Author (GRA)

N77-17917# National Bureau of Standards, Washington, D.C.
DESORPTION METHODS AS PROBES OF KINETICS AND BONDING AT SURFACES Interim Report
Theodore E. Madey and John T. Yates, Jr. 16 Aug. 1976 61 p refs
(Contract N00014-76-F-0012)
(AD-A028990) Avail: NTIS HC A04/MF A01 CSCL 07/4

This paper is divided into two parts. Firstly, a review of desorption methods is presented, with emphasis on the use of temperature programmed desorption (TPD) and electron stimulated desorption (ESD) for understanding the bonding of adsorbed species to surfaces. Secondly, recent studies of the angular distribution of ESD ions from adsorbed layers on W(011) are discussed. The ESD of O(+) ions from oxygen adsorbed on a stepped W(011) surface is shown to be sensitive to the presence of atom steps. Author (GRA)

N77-17918# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PHOTOLUMINESCENCE OF GALLIUM PHOSPHIDE M.S. Thesis
Harley H. Pritchard, Jr. Apr. 1976 93 p refs
(AF Proj. 7371)
(AD-A029011; GEO/PH/76J-6) Avail: NTIS HC A05/MF A01 CSCL 07/4

The photoluminescence emission spectra from four GaP crystals were studied in order to characterize their impurity content. The temperature dependent behavior of the emission spectra was studied in the temperature range of 4.2 Kelvin to 100 Kelvin using liquid helium and the cold gas from evaporating liquid helium as the coolant. An argon-ion laser operating at 4579A and 150mw power output was used to excite the crystals, and the spectra were detected photoelectrically. The inadvertent impurities present in the crystals are nitrogen, sulfur, carbon, and silicon, with nitrogen related spectra seen in only one sample. Copper doping in one sample seemed to eliminate any evidence of silicon contamination, but switching from quartz to graphite growth crucibles did not. Two distinct spectral features were seen that were not readily identifiable from the literature, and these were attributed to the presence of silicon. Author (GRA)

N77-17299# Osaka Univ. (Japan). Dept. of Electrical Engineering.
ANISOTROPY OF CARRIER MOBILITY AND ELECTRO-OPTICAL EFFECTS IN SMECTIC LIQUID CRYSTALS
Katsumi Yoshino, Nobuyuki Tanaka, Keiichi Kaneto, and Yoshio Inuishi *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 445-454 refs (For primary document see N77-17291 08-31)
(Rept-1317) Avail: NTIS HC A10/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N77-17919*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODELING THE COMPLETE OTTO CYCLE: PRELIMINARY VERSION
Frank J. Zeleznik and Bonnie J. McBride 1977 46 p refs Presented at the Automotive Engineering Congr. and Exposition, Detroit, 28 Feb. - 4 Mar. 1977; sponsored by the Soc. of Automotive Engineers
(NASA-TM-X-73593; E-9065) Avail: NTIS HC A03/MF A01 CSCL 20M

A description is given of the equations and the computer program being developed to model the complete Otto cycle. The program incorporates such important features as: (1) heat transfer, (2) finite combustion rates, (3) complete chemical kinetics in the burned gas, (4) exhaust gas recirculation, and (5) manifold vacuum or supercharging. Changes in thermodynamic, kinetic and transport data as well as model parameters can be made without reprogramming. Preliminary calculations indicate that: (1) chemistry and heat transfer significantly affect composition and performance, (2) there seems to be a strong interaction among model parameters, and (3) a number of cycles must be calculated in order to obtain steady-state conditions. Author

N77-17920# Los Alamos Scientific Lab., N.Mex.
SOME CONSIDERATIONS IN ESTABLISHING THERMODYNAMIC ACTIVITIES FROM HIGH TEMPERATURE EMF MEASUREMENTS
Guy R. B. Elliott 1976 16 p refs Presented at Electrochem. Soc. Meeting, Washington, D.C., 2-6 May 1976
(Contract W-7405-eng-36)
(LA-UR-76-1070) Avail: NTIS HC A02/MF A01

Various sources of uncertainty and error in establishing thermodynamic properties from experimental data were discussed and evaluated. These problems reflected experimental difficulties, the frequent absence of necessary data, some dubious assumptions in the absence of data, certain fallacies when simple models were combined with thermodynamic manipulations to correlate limited or imprecise data, and some ill-chosen methods of describing data. Effects of metal solubility in molten salts, of reactions between electrolyte and metal, of experimental errors, and of poor models were considered. ERA

N77-17306# Osaka Univ. (Japan). Dept. of Mechanical Engineering.
LINEAR VISCOELASTIC MEDIA WITH HIDDEN PARAMETERS [MILIEUX VISCOELASTIQUES LINEAIRES AUX PARAMETRES CACHES]
Kiyoji Nakamura *In its* Technol. Reports of the Osaka Univ., Vol. 26, Nos. 1308-1336 Oct. 1976 p 509-516 refs In FRENCH (For primary document see N77-17291 08-31)
(Rept-1324) Avail: NTIS HC A10/MF A01

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N77-17921# RAND Corp., Santa Monica, Calif.
THE ROLE OF EDUCATION IN FACILITATING ADAPATION TO TECHNOLOGICAL CHANGE. AN ANALYTICAL FRAMEWORK AND REVIEW OF THE LITERATURE Final Report
Duran Bell, Tora K. Bikson, Pamela J. Rich, and Joanne M. Wuchitech Jun. 1976 123 p refs
(Grant NSF RDA-74-20943)
(PB-258286/4; R-1821-NSF; NSF/RDA-74-16) Avail: NTIS HC A06/MF A01 CSCL 05I

An interdisciplinary literature assessment is presented with a problem definition study of the role of the educational system in facilitating the adaptation of individuals to technological change in occupational and social environments. A limited number of population groups, divided into three kinds of adjustments were studied: role conflict (discussed in terms of physicians, engineers, and women physicians), role sequencing (women reentering the labor force), and role loss (elderly individuals). A General adaptation model is developed and related to technological change in occupational and/or social environments. The availability of educational programs to facilitate adaptation is assessed. GRA

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-17922 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DISCRETE PROCESS CONTROL TESTS AND ALGORITHMS IN A DYNAMIC UNSTABLE ENVIRONMENT Ph.D. Thesis
Roger Clayton Gledhill 1976 211 p
Avail: Univ. Microfilms Order No. 77-233

An extension of the dynamic modeling approach called dynamic unstable modeling approach was defined and explored. Statistical tests were developed for detecting shifts in the stable environment which were used for process control in a way analogous to the methods of statistical quality control. The inter-time distributions were assumed to belong to the unimodal subset of the hyper-Erlang family. Algorithms were developed for improved sequencing of transactions, for setting due dates for transactions, and for making short run capacity expansion and contraction decisions. The algorithms were compared and contrasted with currently used algorithms by using a job-shop simulator. Dissert. Abstr.

N77-17923# Argonne National Lab., Ill.
COMPARISON OF THE AMDAHL 470V/6 AND THE IBM 370/195 USING BENCHMARKS
D. R. Snider, J. L. Midlock, A. R. Hinds, and D. E. Engert Mar. 1976 130 p refs
(Contract W-31-109-eng-38)
(ANL-76-50) Avail: NTIS HC A07/MF A01

Six groups of jobs were run on the IBM 370/195 using the current production versions of OS/MVT 21.7 and ASP 3.1. The same jobs were then run on an AMDAHL 470V/6 using the identical operating systems. Performances of the two machines are compared. Differences in the configurations were minimized. The memory size on each machine was the same, all software which had an impact on run times was the same, and the I/O configurations were as similar as possible. This allowed the comparison to be based on the relative performance of the two CPU's. As part of the studies preliminary to the acquisition of the IBM 195, two of the groups of jobs had been run on a CDC 7600, on an IBM 360/195, and on the AMD 360/50/75. ERA

N77-17924# Unternehmensberatung Zangemeister, Cologne (West Germany).
PLANNING AND MULTIPLE CRITERIA DECISION MAKING WITH NAPSY, A COMPUTERIZED SYSTEM FOR EVALUATING COMPLEX ALTERNATIVES Final Report
Christof Zangemeister Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1976 77 p refs In GERMAN; ENGLISH summary
(Contract BMFT-WRT-1073)
(BMFT-FB-W-76-19) Avail: NTIS HC A05/MF A01; ZLDI, Munich, DM 15,35

A survey is presented of the computerized decision making utility analysis system NAPSY. NAPSY is a flexible aid in management problem solving at multiple criteria level when complex alternatives have to be evaluated in regard to a hierarchically structured goal system by different experts. The system allows for sealing preferences, aggregation, and sensitivity analysis, which may be used in a stepwise man-machine problem solving process. ESA

N77-17925# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
AN ANALYTIC APPROACH FOR A CAPACITATED CPM PROBLEM
C. Stafford Loveland and Thom J. Hodgson May 1976 47 p refs
(Contract N00014-76-C-0096)
(AD-A028285; RR-76-12) Avail: NTIS HC A03/MF A01 CSCL 12/2

The capacitated C.P.M. problem with a single resource and jobs having unit duration and requiring a single unit of resource is formulated efficiently as a 0-1 linear integer program. Individual job precedences are combined into groups and modeled as multiple-precedence constraints. The problem of finding the optimal integer solution is one of finding a feasible basis to the linear program which contains the slack variables of the precedence constraints. The special case containing two multiple-precedence constraints is considered. It is shown that an optimal basis of a linear relaxation of the problem is at most two simplex pivots from the basis of an optimal integer solution. GRA

N77-17926# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
MINIMIZING THE COST OF COMPLETING A PROJECT SUBJECT TO A BOUND ON THE EXPECTED DELAY TIME
James E. Falk 14 May 1976 22 p refs
(Contract N00014-75-C-0729; NR Proj. 347-020)
(AD-A027882; Serial-T-336) Avail: NTIS HC A02/MF A01 CSCL 15/5

Given a project with well-defined events and activities, suppose the starting times of the activities are subject to random delays. Suppose it is possible to reduce the magnitude of these delays at additional cost. In this paper, we derive an expression for the total expected delay time of the project, and show that it can be expressed as the maximum of a number of linear expressions. To achieve at most a given expected delay time at minimum cost, we are led to examine an optimization problem with an excessively large number of linear constraints. A simple cutting plane algorithm is applied to the problem, yielding a practical method of solution. A non-convex example with five activities is used to illustrate the method. Author (GRA)

N77-17927# Naval Postgraduate School, Monterey, Calif.
AN IMPLEMENTATION OF A CODASYL BASED DATA BASE MANAGEMENT SYSTEM UNDER THE UNIX OPERATING SYSTEM M.S. Thesis
John Edward Howard Jun. 1976 168 p
(AD-A028893) Avail: NTIS HC A08/MF A01 CSCL 09/2

This thesis reports the implementation of a Data Base Management System (DBMS) based on the CODASYL design. The DBMS was implemented on a DEC PDP 11/50 computer utilizing the UNIX operating system. Background material includes a discussion of data base history and techniques, design of UNIX and the C programming language. The research performed was the adaptation of the CODASYL DBMS design to the UNIX environment and the design of a C language Data Description Language (DDL) and Data Manipulation Language (DML) to interface the DBMS to user programs. Conclusions and recommendations for improvements are also included. Author (GRA)

N77-17928# Naval Training Equipment Center, Orlando, Fla.
PRELIMINARY INVESTIGATIONS CONCERNING THE TRAINING OF TACTICAL DECISION MAKING BEHAVIOR Final Report, Jun. 1974 - Jan. 1976
R. H. Jr. Ahlers Jul. 1976 34 p refs
(AD-A028722; NAVTRAEQUIPC-IH-269) Avail: NTIS HC A03/MF A01 CSCL 05/9

An accelerating trend for military decision making in command and control situations is to provide the decision maker with statistically processed data. There are obvious benefits to be derived from training a decision maker to be a more efficient user of such diagnostic data. But there is little empirical evidence that training is effective in bringing about an enhancement of decision making performance. Two experiments are reported in which it was attempted to determine the effectiveness of a scenario approach for training individuals to make an abstract type of tactical decision based upon probabilistic data. GRA

N77-17929# Defense Systems Management School, Fort Belvoir, Va.
MANAGEMENT BY EXCEPTION: A DECISION PROCESS
George R. Baldwin May 1976 39 p refs
(AD-A028943) Avail: NTIS HC A03/MF A01 CSCL 05/1

The report reviews the history and background of the management by exception concept. The concept is a valid tool in management and is often neglected by managers. The management information and control system is also a tool to be utilized by management and provides an excellent base for the management by exception concept. Once the principles of the concept have been accepted, the project manager may be able to develop more accurate and timely decisions during the decision making process. The report further indicates that the utilization of automatic data processing equipment will enhance management operations and particularly the management by exception concept. GRA

N77-17930# Defense Systems Management School, Fort Belvoir, Va.
APPLICATION OF THE CRITICAL PATH METHOD NETWORK TECHNIQUE TO THE INTEGRATED LOGISTICS SUPPORT PLAN OF THE AIM-9L PROGRAM
Wallace T. Bucher May 1976 37 p refs
(AD-A028923) Avail: NTIS HC A03/MF A01 CSCL 05/1

The purpose of this report is to show how the logistics managers of the AIM-9L program initiated and used a Critical Path Method network to monitor and control the scheduling aspects of their program. The report begins by showing the environment in which the logistics managers were operating and the rationale for the employment of a networking technique. The selection process for the particular networking technique and computer program is shown in detail with emphasis on the selection criteria employed. The construction of the network through the use of a Precedence Diagram is then delineated. The use of the network is shown through the analysis of the output reports. This is intended to provide an example of how a network was successfully initiated and used in the AIM-9L logistics program. Author (GRA)

N77-17931# Defense Systems Management School, Fort Belvoir, Va.
CONTRACT DATA MANAGEMENT
Ronald J. Duddleston May 1976 51 p refs
(AD-A029272) Avail: NTIS HC A04/MF A01

It is the purpose of this paper to provide an overview of the discipline of contract data management and in particular the implementation of DOD data management policies within the NAVAL SEA SYSTEMS COMMAND and its Project Offices. To the end of trying to provide in a single paper that information required by a Program Manager to become sufficiently conversant in the discipline of data management to effectively and efficiently manage his program, this paper has been prepared. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N77-17932# Stanford Linear Accelerator Center, Calif.
INTERACTIVE 3D MOTION GRAPHICS WITH LARGE DATA BASES Ph.D. Thesis
S. R. Levine Mar. 1976 176 p refs
(Contract E(04-3)-515)
(SLAC-192) Avail: NTIS HC A09/MF A01

A graphic data organization was designed that allows for fast access to an arbitrarily large data base. The graphic data were organized by clustering into successively larger spheres. The derived tree structure provided for multilevel descriptions of objects that allow for display of only the amount of detail that was resolved on the display, in addition to rapid determination

of data in the field of view. An algorithm was developed to search for the minimum volume sphere enclosing a set of points in three dimensions. A heuristic was used to speed the search for the minimum volume sphere gaining several orders of magnitude improvement over a nonheuristic search. ERA

N77-17933# Oak Ridge National Lab., Tenn.
NUTIS: NUMERICAL AND TEXTUAL INFORMATION SYSTEM. VERSION 1.1: A DIRECTORY AND INPUT MANUAL
R. H. Strand, R. J. Olson, and D. G. Taylor Apr. 1976 49 p refs
(Contract W-7405-eng-75)
(EDFB-IBP-75-7) Avail: NTIS HC A03/MF A01

NUTIS, the Numerical and Textural Information System, was developed to aid in managing numerous and diverse data sets generated by environmental research programs. A batch system provides efficient computer storage and retrieval of numeric data sets and associated textual descriptions. This manual describes the textual identifiers in the NUTIS directory and discusses edition and formation of new data sets, data bank policies, and data access control. Procedures and computer job decks for accessing and maintaining the data bank are presented. ERA

N77-17934# Vanderbilt Univ., Nashville, Tenn. Div. of Nuclear Medicine and Biophysics.
INTRODUCTION TO HARDWARE FOR NUCLEAR MEDICINE DATA SYSTEMS
Jon J. Erickson 1976 9 p refs Presented at 6th Symp. on the Sharing of Computer Programs and Technol. in Nuclear Medicine, Atlanta, 26 Jan. 1976
(Contract AT(40-1)-2401)
(ORO-2401-88; Conf-760119-4) Avail: NTIS HC A02/MF A01

Hardware included in a computer-based data system for nuclear medicine imaging studies is discussed. Emphasis is placed on the effect of the various portions of the system on the final application in the nulcear medicine clinic. ERA

N77-17935# California Univ., Berkeley. Lawrence Berkeley Lab.
BDMS: BERKELEY DATA-BASE MANAGEMENT SYSTEM USER'S MANUAL, VERSION 1.2
David R. Richards Apr. 1976 31 p refs Sponsored by ERDA
(LBL-4683) Avail: NTIS HC A03/MF A01

BDMS is a general-purpose data-base management and information retrieval system with a broad range of capabilities for creating, maintaining, and accessing computer data bases. Its capabilities include a natural and easy-to-use data base definition language; a powerful editor that operates directly on the data base; extensive retrieval facilities including controlled data-base inversion, and Boolean and relational operators.
Author (ERA)

N77-17936# Informatics, Inc., Rockville, Md.
PRACTICAL INFORMATION NETWORKING: AN EXPERIMENTAL DESIGN FOR EARLY DEVELOPMENT OF NATIONAL INFORMATION SERVICES Final Report, 1 Jun. 1975 - 31 Aug. 1976
Aug. 1976 55 p refs Prepared in cooperation with Battelle Columbus Labs., Ohio
(Grant NSF SIS-75-12715)
(PB-258035/5) Avail: NTIS HC A04/MF A01 CSCL 05B

The concept of making information resources and services immediately available to managers and planners of new federal programs that respond to legislation on national issues was ascertained. Functional, structural and procedural models of information systems, services and resources were used to develop guidelines for selecting the most promising combination of information activities for rapid use. GRA

N77-17937# National Bureau of Standards, Washington, D.C.
DATA BASE DIRECTIONS: THE NEXT STEPS Final Report
John L. Berg, ed. Sep. 1976 177 p refs Conf. Proc. of the Workshop of the Natl. Bureau of Standards and the Association for Computing Machinery, Ft. Lauderdale, Fla., 29-31 Oct. 1975 Sponsored in part by the Association for Computing Machinery, Ft. Lauderdale, Fla., 29-31 Oct. 1975
(PB-258103/1; NBS-SP-451; LC-76-608219) Avail: NTIS HC A09/MF A01 CSCL 09B

A workshop of approximately 80 experts in five major subject areas was established. The five subject areas were auditing, evolving technology, government regulations, standards, and user experience. The proceedings provide guidance on steps managers should follow to prepare themselves and their organization for the installation of data base management concepts. GRA

N77-17938# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
TWO PERSON INFORMATION STRUCTURE. PART 1: INFORMATION STRUCTURE: COMMON AND PRIVATE. PART 2: PRIVATE INFORMATION STRUCTURES OF A WITH RESPECT TO B
Y. C. Ho, G. Hexner, and C. Martin Jul. 1976 35 p refs
(Contract N00014-75-C-0648; Grant NSF GK-31511)
(AD-A028373; TR-663) Avail: NTIS HC A03/MF A01 CSCL 12/2

New definitions are introduced for the common and private information structures between two decision makers and show that they satisfy various reasonable properties. GRA

N77-17939# RAND Corp., Santa Monica, Calif.
ALTERNATIVES OF TRADITIONAL FORMS OF SCIENTIFIC COMMUNICATION
Constance U. Greaser Feb. 1976 23 p refs Presented at the 17th Ann. Conv. of the Intern. Studies Assoc., Toronto Ontario, 25-29 Feb. 1976
(AD-A027873; P-5597) Avail: NTIS HC A02/MF A01 CSCL 05/2

Scholars are well aware of the burgeoning growth in journals and other forms of scientific communication, just as they are all too familiar with the fact that the costs of processing this information are also skyrocketing. Ways must be found to bring costs down to a manageable level and still make possible more effective and efficient dissemination of the vast amounts of information. There are many experiments currently under way to help solve these problems, and additional research is being done on other alternatives to traditional forms of scientific communication. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-17940*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
LOW COST PROGRAM PRACTICES FOR FUTURE NASA SPACE PROGRAMS, VOLUME 1 Final Report, Jun. 1974 - Dec. 1975
15 Dec. 1975 65 p
(Contract NASw-2752)
(NASA-CR-149656; LMSC-D469858-Vol-1; LMSC-D469857-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 05C

The progress and outcomes of a NASA/HQ indepth analysis of NASA program practices are documented. Included is a survey of NASA and industry reaction to the utility and application of a Program Effects Relationship Handbook. The results and outcomes of all study tasks are presented as engineering memoranda as the appendix. Author

N77-17941*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
LOW COST PROGRAM PRACTICES FOR FUTURE NASA SPACE PROGRAMS. VOLUME 2: APPENDIX Final Report
15 Dec. 1975 487 p refs
(Contract NASw-2752)
(NASA-CR-149657; LMSC-D469858-Vol-2-App;

LMSC-D469857-Vol-2-App) Avail: NTIS HC A21/MF A01 CSCL 05C

For abstract, see N77-17940.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N77-17942# Committee on Science and Technology (U. S. House).

NASA AUTHORIZATION, 1978, VOLUME 1, PART 1

Washington GPO 1977 655 p refs Hearings on H.R. 2221 before Subcomm. on Space Sci. and Applications of Comm. on Sci. and Technol., 94th Congr., 2d Sess., 14-16 Sep. 1976 (GPO-79-706) Avail: Subcomm. on Space Sci. and Applications

NASA research and development activities are described in detail to justify allocations authorized in the budget. A.H.

N77-17943# Committee on Science and Technology (U. S. House).

NASA AUTHORIZATION, 1978, VOLUME 2, PART 1

Washington GPO 1976 259 p refs Hearings on H.R. 2221 before Subcomm. on Aviation and Transportation R and D of the Comm. on Science and Technol., 94th Congr., 2d Sess., 14-15 Sep. 1976

(GPO-70-664) Avail: Subcomm. on Aviation and Transportation R and D

For abstract, see N77-17942.

N77-17944# Committee on Aeronautical and Space Sciences (U. S. Senate).

SPACE LAW: SELECTED BASIC DOCUMENTS

Washington GPO 30 Dec. 1976 465 p refs Rept. for Comm. on Aeronautical and Space Sci., 94th Congr., 2d Sess., 30 Dec. 1976

(GPO-80-608) Avail: Comm. on Aeronautical and Space Sci.

Texts included are: (1) Treaty Banning Nuclear Weapon Tests in the Atmosphere, In Outer Space and Under Water; (2) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies; (3) Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space; (4) Convention on International Liability for Damage Caused by Space Objects; (5) Convention on Registration of Objects Launched into Outer Space; (6) International Telecommunications Satellite Organization; (7) European Space Agency: Convention for the Establishment of a European Space Agency; Final Act of the Conference of Plenipotentiaries for the Establishment of a European Space Agency; (8) International Telecommunication Convention and Radio Regulations International Telecommunication, Convention Excerpt on Composition, Purposes and Structure; (9) AEROSAT; (10) INTERSPUTNIK; (11) Arab Corporation for Space Communications; and (12) U.S. National Space Legislation and Policies. Author

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N77-17945 Florida Univ., Gainesville.

RECYCLING OF ALUM USED FOR PHOSPHATE REMOVAL IN DOMESTIC WASTEWATER TREATMENT Ph.D. Thesis

David Alan Cornwell 1975 225 p

Avail: Univ. Microfilms Order No. 77-140

A procedure is described for the economical recovery of the aluminum used as a coagulant for phosphorus removal in domestic wastewater treatment. The process was developed using synthetic solutions. Sewage treatment plant sludge was then used to predict the prototype operating parameters. The sludge was thickened to obtain a solids concentration of about four times that of the raw sludge. The sludge was then reacted with sulfuric acid to dissolve the aluminum and phosphate. In order to separate the acidified aluminum from the phosphate. A kerosene solution of alkyl phosphates was contacted with the aluminum-phosphate solution in a mixer. The alkyl phosphates reacted with the aluminum, causing the aluminum to become kerosene soluble. The overall aluminum recovery was between 89% and 93%. Dissert. Abstr.

N77-17946 Pennsylvania Univ., Philadelphia.

INTER AND INTRA URBAN FREIGHT TRANSPORTATION VIA PIPELINE Ph.D. Thesis

Kenneth K. Gimm 1976 244 p

Avail: Univ. Microfilms Order No. 77-830

The feasibility and viability of freight pipeline (solid pipeline) as an effective mode of transporting solid commodities in inter and intra urban traffic markets are investigated. The technological feasibility is studied for four types of freight pipeline: slurry pipeline, pneumatic pipeline, pneumo-capsule pipeline, and hydrocapsule pipeline. A cost and performance model for freight pipeline is used to compare the direct dollar cost of freight pipeline with that of the existing freight transport systems. Advantages in terms of environmental impact, including reduced air and noise pollutions, less accidents, less energy consumption, and reduced traffic congestion are discussed. Dissert. Abstr.

N77-17947*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RESULTS OF BASELINE TESTS OF THE LUCAS LIMOUSINE

Richard F. Soltis, Miles O. Dustin, and Noel B. Sargent Jan. 1977 29 p Sponsored in part by ERDA

(NASA-TM-X-73609; E-9075) Avail: NTIS HC A03/MF A01 CSCL 13F

The Lucas Limousine, an electric vehicle, was tested to assess the state-of-the-art of electric vehicles. All tests were made without the regenerative braking system and were conducted at the gross vehicle weight of 7,700 pounds. Over a 30 mph stop and go driving cycle the vehicle went 48.4 miles. The vehicle was able to accelerate to 30 mph in about 15 seconds with a gradeability limit of 16.5 percent. As determined by coast down tests the road power and road energy consumption for the vehicle were 2.92 kilowatts and 0.146 kWh/mi, respectively, at 20 mph. At 40 mph the road power requirement was 11.12 kilowatts and the road energy requirement was 0.278 kWh/mi. The maximum energy economy measured 0.45 kilowatt hours per mile at 30 mph and increased to 0.76 kilowatt hours per mile at 50 mph. Over the 30 mph stop and go driving cycle the energy economy was 0.92 kilowatt hours per mile. Author

N77-17948# Advisory Group for Aerospace Research and Development, Paris (France).

NATIONAL DELEGATES BOARD MEETING. TECHNICAL PRESENTATIONS ON SCIENTIFIC AND TECHNOLOGICAL FORECASTING

Jun. 1976 31 p In ENGLISH; partly in FRENCH Conf. held at Paris, 18 Mar. 1976

(ISBN-92-835-0170-0) Avail: NTIS HC A03/MF A01

There are three papers presented on scientific and technological forecasting delivered at the Technical Presentations Session of the AGARD Spring 1976 National Delegates Board Meeting. Author

N77-17949*# National Aeronautics and Space Administration. Pasadena Office, Calif.

PROCESS FOR PURIFICATION OF WASTE WATER PRODUCED BY A KRAFT PROCESS PULP AND PAPER MILL Patent Application

Marshall Humphrey, inventor (to NASA) (JPL) Filed 15 Dec. 1976 13 p

(Contract NAS7-100)

(NASA-Case-NPO-13847-2; NASA-Case-NPO-13848-2; US-Patent-Appl-SN-750798) Avail: NTIS HC A02/MF A01 CSCL 13B

A method and means for purifying the waste water from paper and pulp mill wastes obtained from a mill using the Kraft process were ascertained. Lignins and lignin derivatives were precipitated from the waste stream with quaternary ammonium compounds, removing other impurities by activated carbon produced from the cellulosic components of the waste, and thereafter separating water from the precipitate and solids. The activated carbon also acted as an aid to the separation of the water and solids. The precipitate containing the lignins and quaternary ammonium compound was dissolved in methanol to recover lignins. Upon acidification, the lignin was precipitated from the solution. The methanol and quaternary ammonium compound were recovered for reuse from the remainder. NASA

N77-17950# Oak Ridge National Lab., Tenn.
MIUS TECHNOLOGY EVALUATION: THERMAL ENERGY CONVEYANCE
J. T. Meador May 1976 95 p refs
(Contract W-7405-eng-26)
(ORNL/HUD/MIUS-22) Avail: NTIS HC A05/MF A01

The types, cost, and performance of several types of conduits for thermal energy conveyance. Conduits applicable to water conveyance of thermal energy produced are evaluated from data on characteristics and economic factors related to district heating and cooling systems for housing developments. Materials of construction are considered according to the demands of a conduit: (1) the pipe must meet the requirements for conveyance of the heat-transfer media; (2) the insulation must limit thermal losses; and (3) some form of encasement must protect the pipe and insulation from both external loads and the underground environment. Factors such as heat transfer characteristics, thermal expansion, and creep strength at operating temperature must be considered in the selection of conduit materials. Commercially available prefabricated conduits with or without insulation are considered with respect to their ability to meet energy conveyance requirements at installed costs that are based on present-data economics. ERA

N77-17951# Oak Ridge National Lab., Tenn.
MIUS TECHNOLOGY EVALUATION: PRELIMINARY SUBSYSTEM RECOMMENDATIONS FOR NEAR-TERM CONCEPTS
G. Samuels and W. J. Boegly, Jr. May 1976 60 p refs
(Contract W-7405-eng-26)
(ORNL/HUD/MIUS-17) Avail: NTIS HC A04/MF A01

A few examples of what major components and subsystems might be incorporated into a typical MIUS are described together with possible methods of integration. Maximum effort was made to include all possible community services: power generation, space heating and cooling, domestic hot water, potable water, fire-protection water, and liquid and solid waste treatment and disposal. In some of the examples cited complete thermal integration has not been obtained, and in certain cases integration of the liquid waste subsystem is merely the use of treated effluents for fire-protection or cooling tower makeup. Schematic diagrams are provided of several MIUS configurations; however, it must be pointed out that these are not necessarily the optimum configurations. The main purpose of this report is to illustrate how MIUS can be assembled using available technologies, and some of the alternate possibilities. Author

N77-17952# Brookhaven National Lab., Upton, N.Y.
MULTI-OBJECTIVE ANALYSIS OF ERDA COMBINED TECHNOLOGY SCENARIOS
K. C. Hoffman, M. Beller, E. A. Cherniavsky, and M. Fisher Jan. 1976 17 p refs
(Contract E(30-1)-16)
(BNL-21091) Avail: NTIS HC A02/MF A01

The multi-objective analyses were performed for the years 1985 and 2000, allowing all technologies to compete and be utilized. The specific objectives addressed were: (1) total annual cost, including amortized capital, fuel, and operating costs; (2) capital requirements; (3) resource use; (4) imported oil requirements; and (5) environmental effects. The objective function used for environmental effects was a weighted sum of selected emissions. The ERDA Case 0 emission inventory was analyzed, and weightings were applied reflecting the relative degree of concern over specific emissions (referred to the total level). The analysis consisted of three steps: determination of the unconstrained minimum for each of the five objectives; trade-off analyses; and development of best combined case. The results of the best combined cases and the resource usage and environmental effects for all cases are presented. ERA

N77-17953# National Swedish Road and Traffic Research Inst., Linkoeping.
ASPHALT CONCRETE HAB 16 WITH HIGH CONTENT OF PARTICLES SIZED 8-16 mm AND OF FILLER. MIX DESIGN STUDIES AND PREPARATION OF SLABS FOR A TEST RUN WITH STUDDED TIRES IN A TRAFFIC SIMULATOR [ASFALTBETONG HAB16 MED HOEG HALT AV KORNFRAKTION 8-16 mm OCH AV FILLER. PROPORTIONERINGSSTUDIER OCH FRAMSTAELLNING AV PLATTOR TILL EN KOERNING MED DUBBADE PERSONBILSDAECK I INSTITUTETS PROVVAEGSMASKIN]
Aake Rosengren and Mats Hansson 1975 80 p refs In SWEDISH; ENGLISH summary
(VTI-62) Avail: NTIS HC A05/MF A01

A mix design study was conducted in order to prepare an assortment of specimens of asphalt concrete, HAB 16 (maximum particle size 16 mm) for the testing of wear resistance to studded tires in a traffic simulator. This was made on Marshall specimens of systematically varied compositions and on slabs prepared by rolling mixtures obtained from the tested Marshall specimens. Series of slabs were then prepared for the traffic simulator test. The aggregate in the samples contained at least 9% filler and consisted of crushed material. Author (ESA)

N77-17954# Environmental Protection Agency, Washington, D.C. Div. of Water Planning.
IMPLEMENTING BEST MANAGEMENT PRACTICES FOR RESIDUALS: THE WASTE EXCHANGE
Alan K. Vitberg and Michael L. Rucker Jun. 1976 31 p refs
(PB-258068/6; EPA-440/9-76-019) Avail: NTIS HC A03/MF A01 CSCL 13B

The premise is that many wastes contain valuable materials, some of which are in short supply. Extraction of materials from these wastes makes sense from both the conservational and the environmental points of view. Industry can dispose of its unwanted wastes and perhaps receive a monetary bonus. The waste receiver can potentially reduce costs for materials. In addition, the environment is saved from the introduction of potential pollutants from land and water disposal methods. GRA

N77-17955# Environmental Protection Agency, Washington, D.C. Office of Solid Waste Management Programs.
DESIGN CRITERIA FOR SOLID WASTE MANAGEMENT IN RECREATIONAL AREAS
Harry R. Little 1972 76 p refs
(PB-258597/4; EPA-SW-91ts) Avail: NTIS HC A05/MF A01 CSCL 13B

Because of the periods of low usage that occur in recreational areas, the overall solid waste disposal system cost on a basis of dollars per ton or per can is much higher than in an urban area where continuous use tends to reduce the unit cost. Data from recent studies, demonstrations, and research projects are presented for consideration in designing a system. GRA

N77-17956# Gruen Associates, Los Angeles, Calif.
COMMUNITY MONITORING
Mai. 1976 46 p refs Sponsored in part by HUD. Prepared in in cooperation with Curtis Associates
(Contract DOT-OS-30176)
(PB-258369/8; DOT-BIP-WP-22-4-76) Avail: NTIS HC A03/MF A01 CSCL 13B

The environment project's community monitoring program served as a source for substantive findings on response to impacts, and as an aid in overall research design. It functioned through a variety of non-random, qualitative techniques to gain information on the general nature of community concerns. GRA

N77-17957# New Jersey State Dept. of Transportation, Trenton. Div. of Research and Development.
ENSURING RELIABILITY OF MAYS ROUGHNESS MEASUREMENTS Final Report
Jack Croteau Mar. 1976 51 p Prepared in cooperation with

the Federal Highway Admin., Washington, D.C.
(PB-257619/7; FHWA-NJ-RD-76-005; Rept-76-005-7776) Avail: NTIS HC A04/MF A01 CSCL 13B

A measurement device known as the Mays Ride Meter is extensively used to quickly and inexpensively determine relative pavement roughness. A set of procedures for systematically monitoring the output of the New Jersey Mays device was presented so as to determine if the equipment was functioning properly and providing reliable measurements. The nature and relative magnitude of the various individual components of Mays measurement variability were considered. GRA

N77-17958# Office of Technology Assessment, Washington, D.C.
A REVIEW OF THE US ENVIRONMENTAL PROTECTION AGENCY ENVIRONMENTAL RESEARCH OUTLOOK, FISCAL YEAR 1976 THROUGH 1980
Aug. 1976 116 p refs
(PB-258191/6; OTA-E-32) Avail: NTIS HC A06/MF A01 CSCL 13B

The Environmental Protection Agency expanded the public dialog necessary to identify and establish national environmental goals. The plan emphasized the development and demonstration of control technologies. In many cases, larger problems involve social, economic, and institutional patterns which not only impede technical solutions but which require nontechnical approaches. GRA

N77-17959# SCS Engineers, Long Beach, Calif.
OPTIMIZATION OF OFFICE PAPER RECOVERY SYSTEMS Final Report
May 1976 83 p refs Prepared in cooperation with SCS Engineers, Reston, Va.
(Contract EPA-68-01-3192)
(PB-257955/5) Avail: NTIS HC A05/MF A01 CSCL 13B

Source separation was assessed as a viable resource recovery option in office buildings. Three basic approaches to office building source separation were studied in twelve case study locations: desk top; dual basket; and central container. GRA

N77-17960# Southern Methodist Univ., Dallas, Tex. Dept. of Civil and Mechanical Engineering.
FLUIDIZED VORTEX INCINERATION OF WASTE Final Report, May 1970 - Aug. 1974
Jack P. Holman and Richard A. Razgaitis Aug. 1976 337 p refs
(Grant EPA-R-801078)
(PB-258071/0; EPA-600/2-76-225) Avail: NTIS HC A15/MF A02 CSCL 13B

The incinerator consisted of a vortex combustion chamber and a cooled vertical furnace column 5 feet long and half a foot in diameter. (No transition section was used.) The vortex incinerator was operated using propane, sawdust/propane, and sawdust. The principle experiments were performed using propane at air/fuel ratios and total mass flow rates (in lbs per hour) in three combinations: 15 and 125, 20 and 220, and 20 and 280. Radial temperature profiles and heat transfer to the wall of the vortex tube were measured as a function of air/fuel ratio, vertical position, total gas flow rate, and inlet/outlet configurations. Maximum energy fluxes experienced were on the order of 37,000 Btu/hr/sq ft. GRA

N77-17961# SYSTAN, Inc., Los Altos, Calif.
DEPLOYMENT SCENARIOS FOR INTEGRATED REGIONAL TRANSPORTATION NETWORKS Final Report
J. W. Billheimer, R. Bullemer, and M. Holoszyc Aug. 1976 145 p refs
(Contract DOT-OS-50265)
(PB-257742/7; Systan-D147-1; DOT-TST-76T-7) Avail: NTIS HC A07/MF A01 CSCL 13B

The cost and service implications of alternative scenarios for the deployment of an integrated regional transportation system in a hypothetical city are described. The impacts of various levels of user acceptance are investigated. For the selected study area, a limited expansion of integrated transit service to suburbs, and the improvement of off peak suburban service through the use of flexible route systems appears desirable. In view of the large areas and low suburban population densities characterizing the study region, full coverage of the entire suburbs appears to be economically feasible only at reduced service frequencies. GRA

N77-17962# Urban Inst., Washington, D.C.
LAND DEVELOPMENT AND THE NATURAL ENVIRONMENT: ESTIMATING IMPACTS Final Report
Dale L. Keyes Apr 1976 128 p refs Sponsored by HUD
(PB-258431/6; URI-13500; ISBN-0-87766-158-8; LC-76-10104) Avail: NTIS HC A07/MF A01 CSCL 13B

Land development and how it may adversely affect the natural environment is discussed along with how the natural environment may pose problems for development. The relative merits of alternative techniques for forecasting impacts, in light of the costs, skills and data required by each technique and the validity of the results, where such information exists, are summarized. Development impacts and air quality, water quality and quantity, noise, scarce resource use, wildlife, vegetation, flooding and natural disasters are discussed. Simple manual projection procedures as well as complex, computerized assessment techniques are examined for each impact category (except for scarce resources and disasters other than flooding) and for three types of development -- residential, commercial and industrial. GRA

N77-17963# Versar, Inc., Springfield, Va.
DESTRUCTION OF POLYCHLORINATED BIPHENYLS IN SEWAGE SLUDGE DURING INCINERATION Final Report
Frank C. Whitmore 1976 80 p refs
(Contract EPA-68-01-1587)
(PB-258162/7) Avail: NTIS HC A05/MF A01 CSCL 13B

The efficiency with which PCB's are destroyed in a municipal sewage sludge incinerator was determined. A standard mixture of PCB's was injected into the sludge cake at the rate of 50 ppm (dry solids basis) under conditions whereby the various emergent streams from the furnace were monitored. No PCB's were present in either the scrubber exhaust water or in the ash; the amount of PCB in the emergent stack gases was found to correspond to destruction ratios in excess of 0.94 under normal furnace operating conditions. GRA

N77-17964# Environmental Protection Agency, Atlanta, Ga. Region 4.
ARLINGTON-EAST SERVICE DISTRICT, WASTEWATER MANAGEMENT FACILITIES, JACKSONVILLE, FLORIDA PROJECT NO. C120541 Final Environmental Impact Statement
6 Aug. 1976 252 p refs
(PB-258590/9; EPA-904/9-76-021) Avail: NTIS HC A12/MF A01 CSCL 13B

The final environmental impact statement is presented on the awarding of grant funds for the preparation of plans and specifications for regional waste water treatment facilities to serve the Arlington-East District. The project consists of a 10.0 mgd wastewater treatment plant, a 13,900 foot outfall line to the St. Johns River, and a 38,000 foot force main which will be used to pump sludge from the proposed facility across the St. Johns River for incineration. Revisions and additions to the draft are detailed, the principle revision being the elimination of incineration and sludge handling facilities at the plant. GRA

N77-17965# USSR-US Joint Committee on Cooperation in the Field of Environmental Protection.
HANDLING TREATMENT AND DISPOSAL OF WASTEWATER SLUDGE
16 May 1975 155 p refs Symp. held at Moscow, 13-16 May 1975; sponsored in part by EPA
(PB-258169/2) Avail: NTIS HC A08/MF A01 CSCL 13B

Proceedings on wastewater disposal are presented. Symposium was held in Moscow; sponsored in part by Environmental Protection Agency, Washington, D. C. The papers presented cover a wide range of topics in the field of sludge treatment and disposal. I.M.

N77-17966# City of Cleveland, Ohio. Dept. of Public Works.
DEMONSTRATION OF INTERIM TECHNIQUES FOR RECLAMATION OF POLLUTED BEACHWATER Final Report
James F. Weber Sep. 1976 183 p refs
(Grant EPA-11020-EZW)

(PB-258192/4; EPA-600/2-76-228) Avail: NTIS HC A09/MF A01 CSCL 13B

The shores of Lake Erie, bordering Cleveland, which had become contaminated because of combined sewer overflows, were made safe for swimming through the use of various interim techniques. These techniques were designed to keep beaches safe until long range goals such as an expanded sewage system can be implemented. The swimming areas at White City and Edgewater beaches were disinfected with sodium hypochlorite and enclosed by fabric barriers. The barriers provide protection from contamination of the beaches by floating debris and retarded the diffusion of disinfectant into deep waters. The other techniques which were attempted were: streams and combined sewer overflows were screened and treated with sodium hypochlorite; lateral sewers were flushed to reduce the 'first slug' effect; and physical cleanup of the beaches and water was made. GRA

N77-17967# Jacobs Engineering Co., Pasadena, Calif.
ASSESSMENT OF HAZARDOUS WASTE PRACTICES IN THE PETROLEUM REFINING INDUSTRY Final Report
D. G. Rosenberg, R. J. Lofy, H. Cruse, E. Weisberg, and B. Beutler Jun. 1976 369 p refs
(Contract EPA-68-01-2288)
(PB-259097/4; EPA-SW-129c) Avail: NTIS HC A17/MF A01 CSCL 07A

Hazardous waste generation and management practices within the petroleum refining industry are reviewed. Waste streams emanating from individual refining process sources are characterized and described in detail. Topics covered include: characterization of the petroleum refining industry, criteria for identification of potentially hazardous wastes, analytical methods and quality control procedures; waste characterization, treatment and disposal technologies, and treatment and disposal costs. GRA

N77-17968# Massachusetts Univ., Amherst. Water Resources Research Center.
EVALUATION OF PROPOSED MAN-MADE PONDS FOR FOOD PRODUCTION TO RECOVER VALUES IN WASTE HEAT AND SOLID ORGANIC SLUDGES Completion Report
John W. Zahradnik, Larry S. Turner, Howard L. Levine, and Charles Tucker Mar. 1976 64 p refs Sponsored by Office of Water Res. and Tech.
(PB-258773/1; Completion-FY-76-12; W77-00150; OWRT-A-079-MASS(1); Pub-65) Avail: NTIS HC A04/MF A01 CSCL 13B

The potential value of using, simultaneously, thermal effluents and sewage sludges in aquatic cultures is analyzed. The technical and economic feasibility of utilizing multilevel aquatic cultures in the recovery of these wastes is investigated. Data voids and uncertainties which are of importance in implementation of the system designed are discussed. System inputs, potential system outputs and potential subsystem characteristics are characterized and documented through a literature survey. GRA

N77-17969# Versar, Inc., Springfield, Va.
ASSESSMENT OF INDUSTRIAL HAZARDOUS WASTE PRACTICES, TEXTILES INDUSTRY Final Report, Apr. - Dec. 1975
E. F. Abrams, D. K. Guinan, and D. Derkigs Jun. 1976 276 p refs
(Contract EPA-68-01-3178)
(PB-258953/9; EPA-SW-125c) Avail: NTIS HC A13/MF A01 CSCL 13B

Heavy metals such as cobalt, lead, chromium, and copper used in some of the dyeing and finishing operations of the textiles industry can be toxic in certain concentrations and forms. The various dyes and organic chemicals used were considered for potential hazard as well as toxicity. The potentially hazardous wastes destined for land disposal include dye and chemical containers with residuals and wastewater treatment sludges. The amount of sludges is expected to increase as effluent guidelines limitations are implemented. GRA

N77-17970# Action for Bridgeport Community Development, Inc., Conn.
FRONT END RECYCLING: A STUDY OF THE ECONOMICS OF RECYCLING BY SOURCE SEPARATION AND ITS APPLICATION FOR FAIRFIELD COUNTY, CONNECTICUT
Ronald Fattibene and Irving Moy Jun. 1976 94 p refs Sponsored by the Conn. Resources Recovery Authority and the Economic Development Admin.
(PB-257404/4; EDA-76-043) Avail: NTIS HC A05/MF A01 CSCL 13B

The feasibility of a technology system for recycling by source separation and to determine the practicability of instituting such a system and the resulting economic impact of such an enterprise in Fairfield County is assessed. Factors to be explored in the course of the study were creation of new jobs, new business, cost benefits from the sale of recycled materials, and cost savings to communities. Conclusions and recommendations reflect the system as it existed at this writing. GRA

N77-17971# Urban Mass Transportation Administration, Washington, D.C. Office of Policy and Program Development.
TRANSPORTATION SYSTEM MANAGEMENT: A BIBLIOGRAPHY OF TECHNICAL REPORTS Final Report
Richard L. Oram May 1976 153 p Sponsored in part by Federal Highway Admin., Washington, D.C.
(PB-257273/3; UMTA-UPP-L-76-1) Avail: NTIS HC A08/MF A01 CSCL 13B

Descriptions and availability information on over 150 reports dealing with low capital, short range, or policy oriented urban transportation improvements are included and classified into 9 sections. The first, General, includes transportation management overviews, survey reports on the various operational approaches and strategies for improved transportation efficiency, and demonstration program reports. The remaining sections contain more focused reports in the following areas: Preferential Treatment for High Occupancy Vehicles, Traffic Operations, Parking Management, Transit Improvements, Transit Management, Pooling and Paratransit. GRA

N77-17972# Pratt (R. H.) Associates, Inc., Kensington, Md.
SOFTWARE SYSTEMS DEVELOPMENT PROGRAM. UMODEL USER'S GUIDE WITH CASE STUDIES
G. W. Schultz Feb. 1976 342 p refs
(Contract DOT-UT-20020)
(PB-258320/1; UMTA-IT-06-0050-76-1) Avail: NTIS HC A15/MF A01 CSCL 13B

The report is divided into two sections. The first section describes the default model, contains a general description of program UMODEL and discusses program formats and potential output files and reports. Six case studies illustrate its application. For the reader who wishes to know what the program is and what it can do, this first section should suffice. The second section describes methods of application and uses a comprehensive series of case studies to illustrate these methods. Each case study includes a description of the problem to be solved and a list of the input data, necessary subroutine(s) and a listing of the complete UMODEL run. GRA

N77-17973# Public Technology, Inc., Washington, D.C.
TRANSPORTATION NEED SUMMARY: A REPORT OF THE TRANSPORTATION TASK FORCE OF THE URBAN CONSORTIUM FOR TECHNOLOGY INITIATIVES
Sep. 1976 42 p
(Contract DOT-OS-60076)
(PB-258872/1; DOT-TST-76T-15) Avail: NTIS HC A03/MF A01 CSCL 13B

The results of the extensive needs identification and screening process conducted by the member cities and counties of the Urban Consortium for Technology Initiatives are reported. Chapter I provides an overview of this unique needs identification process used by the Consortium. While the needs selection process provided the basis for forming the Task Forces for all nine need areas, this report focuses on the work of the Transportation Task Force. The process by which the Transportation Task Force screened the original 94 transportation needs identified by the Consortium members to its top 10 priority needs is described. Chapter 1 also contains a status report on Consortium work in four of the top priority need areas. GRA

N77-17691*# General Electric Co., Philadelphia, Pa. Space Div.

BENEFICIAL USES OF SPACE
H. L. Bloom *In* NASA. Lyndon B. Johnson Space Center Bioprocessing in Space Jan. 1977 p 205-218 refs (For primary document see N77-17677 08-51)
Avail: NTIS CSCL 05B

88 SPACE SCIENCES (GENERAL)

N77-17974# Committee on Science and Technology (U. S. House).
BRIEFING ON MARS EXPLORATION
Washington GPO 1976 30 p Hearing before Subcomm. on Space Sci. and Applications of Comm. on Sci. and Technol., 94th Congr., 2d Sess., No. 107, 29 Sep. 1976
(GPO-80-511) Avail: Subcomm. on Space Sci. and Technol.

The planning, progress, and accomplishments of the Viking mission are reviewed. Photographs of the Martian surface are analyzed. Biological and chemical experiments are described, and the results discussed. A.R.H.

N77-17975# Committee on Science and Technology (U. S. House).
INTERNATIONAL SPACE LAW
Washington GPO 1976 54 p refs Hearings before Subcomm. on Space Sci. and Applications of Comm. on Sci. and Technol., 94th Congr., 2d Sess., No. 85, 28-29 Jul. 1976
(GPO-77-586) Avail: Subcomm. on Space Sci. and Applications

Issues under discussion by the United Nations Committee on the Peaceful Uses of Outer Space are reviewed. Recommendations are made for authorization of funds to support U.S. and international cooperative space programs. A.R.H.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-17976*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN INFRARED FOREOPTICS ADAPTOR FOR THE LEARJET TELESCOPE
E. F. Erickson and G. Buck (Beam Eng., Sunnyvale, Calif.) Feb. 1977 12 p refs
(NASA-TM-X-73209; A-6935) Avail: NTIS HC A02/MF A01 CSCL 03A

A foreoptics adapter has been built for the Learjet telescope which permits simultaneous viewing of the visible star field in the image plane and acquisition of astronomical data at infrared wavelengths (less than 1 micrometer). The device uses an adjustable dichroic beamsplitter to transmit visible wavelengths to an eyepiece (or television camera), and to reflect infrared wavelengths to a port where an infrared detector system can be mounted. The instrument is intended as a multiple user facility for the Learjet telescope. This report describes the adapter and its use. Author

N77-17977# Tufts Univ., Medford, Mass. Dept. of Electrical Engineering.
CONTINUED USE AND DEVELOPMENT OF EXISTING BALLOON-BORNE TELESCOPES Final Report, 2 Jan. 1973 - 30 Jun. 1976
Alvin H. Howell 30 Jun. 1976 35 p
(Contract F19628-73-C-0146; AF Proj. 7670)
(AD-A028869; AFGL-TR-76-0146) Avail: NTIS HC A03/MF A01 CSCL 03/1

Primary goal of this contract was to make flight use of two balloon-borne telescope systems that had been built under previous contracts, a 24-inch system and a 50-inch system. A number of significant improvements were incorporated into the 50-inch system that enhanced its capability, and several proposals for other major changes were studied but were not implemented. The 50-inch system was used in all flights because its capability was better suited to the experiment objectives. Extensive work was done on the 24-inch system in the hope that it could be used in daytime experiments, but the target objective of tracking Mercury when it is high in the sky and close to the sun could not be achieved. GRA

N77-17282*# Arizona Univ., Tucson. Dept. of Planetary Sciences.
ASTRONOMICAL IMAGING APPLICATIONS FOR CCDS
Bradford A. Smith *In* JPL Conf. on Charge-Coupled Device Technol. and Appls. 1976 p 135-138 (For primary document see N77-17263 08-31)
(Grant NGL-03-002-002; Contract JPL-954057)
Avail: NTIS HC A11/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N77-17978 Florida Univ., Gainesville.
HIGH RESOLUTION SPECTRAL ANALYSES OF THE JOVIAN DECAMETRIC RADIATION Ph.D. Thesis
Dolores Smoleny Krausche 1976 86 p
Avail: Univ. Microfilms Order No. 77-94

Spectral analyses of Jovian decametric radiation at resolutions of 3.2 kHz and 0.3 msec describe a morphological variation of Io-B emissions ranging from narrowband (50 kHz) simple bursts, which may be grouped in periodic succession, to wideband emissions (extending over a 500-kHz passband) exhibiting complex structural detail. Assuming gyroemission from electrons in a centered dipole field for which the magnetic moment is 10 gauss Jupiter radius cubed, drift rate measurements, -18 to -21.5 MHz/sec for frequencies 20.0 to 26.3 MHz, indicate that the source size is of the order of 20 to 800 km and its location is near R = 1.3 Jupiter radius at a colatitude of 27.3 deg, along the L = 6 shell. Drift rate measurements indicate that the observed radiation is emitted from electrons of a specific equatorial pitch angle population, near 3.5 deg. Dissert. Abstr.

N77-17979 State Univ. of New York, Stony Brook.
HIGH-RESOLUTION SPECTROSCOPY OF JUPITER AND SATURN AT 10 AND 20 MICRONS Ph.D. Thesis
Alan Takashi Tokunaga 1976 117 p
Avail: Univ. Microfilms Order No. 77-230

A Fourier transform spectrometer was used to obtain high resolution spectra of Jupiter and Saturn at 10 and 20 microns. Observations of the V sub 9 fundamental of ethane are presented, and the abundance of ethane and acetylene in the Jovian atmosphere is derived. Results support theoretical models of the methane photochemistry on Jupiter. Observations of Jupiter and Saturn in the 17 to 25 microns spectral range are presented and compared with computed intensities using atmospheric models of the planets. Because the stable forms of sulfur and phosphorus have strong absorption bands at 21.6 microns, upper limits to sulfur and phosphorus of .04 and 2.1 times the solar abundance are derived. Observations of the V sub 2 fundamental of phosphine at 10.1 microns are presented, and support the previous identification of this molecule at this wavelength. Dissert. Abstr.

N77-17980# Royal Greenwich Observatory, Herstmonceux (England).
PROVISIONAL POSITIONS OF THE SUN, MOON AND PLANETS, 1972-1973
K. C. Blackwell, M. E. Buontempo, Patricia Eldridge, and R. H. D. Swifte 1975 37 p refs
(Roy-Obs-Bull-180) Avail: NTIS HC A03/MF A01;

The provisional positions for all members of the solar system observed at Herstmonceux are tabulated. The observation data have been reduced provisionally on the same system as the sun and the planets, 1957-1971, in right ascension with respect to the system of the Fourth Fundamental Catalogue,

and in declination with a value of the mean latitude based on observations made with the photographic zenith tube at Herstmonceux. ESA

N77-17981# Wisconsin Univ., Madison. Mathematics Research Center.
CRITICAL ANGULAR VELOCITY OF UNIFORMLY ROTATING WHITE DWARFS Summary Report
M. J. Miketinac May 1976 27 p refs
(Contract DAAG29-75-C-0024)
(AD-A027895; MRC-TSR-1627) Avail: NTIS HC A03/MF A01 CSCL 03/2

The equilibrium configurations of uniformly rotating white dwarfs are calculated numerically as an application of the finite difference - finite expansion method pioneered by Stoeckly. The latest version of the Harrison-Wheeler equation of state is used, together with the post-Newtonian equations of structure. No other approximation is made. The resulting critical values for the angular velocity agree in order of magnitude with a 'crude' approximation to these values by Hartle and Thorne, but fractional differences in mean radius and in mass and eccentricities are very different. GRA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-17982*# Avco Systems Div., Wilmington, Mass.
STUDY OF THE ABLATIVE EFFECTS ON TEKTITES Final Report, Mar. 1975 - Mar. 1976
Paavo Sepri and Karl K. Chen Mar. 1976 52 p refs
(Contract NAS5-20976)
(NASA-CR-152423; AVSD-0104-76-CR) Avail: NTIS HC A04/MF A01 CSCL 03B

Equations are presented which provide approximate parameters describing surface heating and tektite deceleration during atmosphere passage. Numerical estimates of these parameters using typical initial and ambient conditions support the conclusion that the commonly assumed trajectories would not have produced some of the observed surface markings. It is suggested that tektites did not enter the atmosphere singly but rather in a swarm dense enough to afford wake shielding according to a shock envelope model which is proposed. A further aerodynamic mechanism is described which is compatible with hemispherical pits occurring on tektite surfaces. Author

N77-17983*# Scientific Translation Service, Santa Barbara, Calif.
EMIGRATION TO OTHER PLANETS: A PROSPECT PLANNED FOR THE FUTURE OF MANKIND
Aristedes Bastidas Washington NASA Feb. 1977 7 p Transl. into ENGLISH from Bolentin de la Academia de Ciencias Fiscias, Matematicas y Naturales, Caracas (Venezuela), v. 30, no. 89, 1971 p 93-97
(Contract NASw-2791)
(NASA-TT-F-17399) Avail: NTIS HC A02/MF A01 CSCL 03B

Aspects of the evolution of life on Earth are discussed. The problems to be faced in man's adapting to space life are explored. Author

N77-17984*# Boston Univ., Mass. Dept. of Geology.
THE MORPHOLOGY AND ORIGIN OF HADLEY RILLE, THE MOON Final Report
Thomas Brewer Aug. 1976 281 p refs
(Grant NGR-22-004-027)
(NASA-CR-149585) Avail: NTIS HC A13/MF A01 CSCL 03B

Hadley Rille is directly related to the emplacement of mare basalts in Palus Putredinis. Existing hypotheses of sinuous rille origin are in discord with the cooling behavior of deep lava flows and the strength of materials. It is proposed that Hadley Rille is a channel which returned lava to the southern vent from which it initially extruded and that the channel persisted through many episodes of volcanism. This view is supported by available topographic information obtained by the lunar orbiter photography and the Apollo 15 mission. Author

N77-17985*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.
INVESTIGATION OF HYDROGEN AND HELIUM PUMPING BY SPUTTER ION PUMPS FOR JUPITER AND OUTER PLANETS MASS SPECTROMETER
Burton W. Scott Jan. 1977 44 p refs
(Contract NAS2-9116)
(NASA-CR-151945) Avail: NTIS HC A03/MF A01 CSCL 03B

The phenomena of ion pumping is reviewed with emphasis on the pumping mechanism for hydrogen and helium. The experimental tests measure the performance of a small, flight proven ion pump which has a nominal four liter/second pumping speed for air. The speed of this pump for hydrogen and helium, and for hydrogen/helium mixes, is presented with particular detail regarding the time dependence. Pump test results are related to anticipated performance of the mass spectrometer by the pumping speeds for the gases to the partial pressure in the ion source. From this analysis, the pump specifications are quantified in terms of mission goals and in terms of observed pumping speeds for the various gases, load levels, and time periods. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-17986*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE 15 JUNE 1973 1B/M3 FLARE: AN OVERVIEW OF ANALYSIS RESULTS
Robert M. Wilson Dec. 1976 18 p refs
(NASA-TM-X-73357) Avail: NTIS HC A02/MF A01 CSCL 03B

The 15 June 1973 1B/M3 flare was analyzed as one of the best observed flares during the skylab mission. Author

N77-17987*# Alabama Univ., Huntsville. Center for Environmental and Energy Studies.
SOLAR RADIATION OBSERVATION STATIONS WITH COMPLETE LISTING OF DATA ARCHIVED BY THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA AND INITIAL LISTING OF DATA NOT CURRENTLY ARCHIVED
E. A. Carter, R. E. Wells, B. B. Williams, and David L. Christensen Nov. 1976 62 p refs Prepared for ERDA, Washington, D.C.
(Contract NAS8-31293)
(NASA-CR-150177) Avail: NTIS HC A04/MF A01 CSCL 03B

A listing is provided of organizations taking solar radiation data, the 166 stations where observations are made, the type of equipment used, the form of the recorded data, and the period of operation of each station. Included is a listing of the data from 150 solar radiation stations collected over the past 25 years and stored by the National Climatic Center. Author

N77-17988*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SKYLAB ATM/S-056 X-RAY EVENT ANALYZER OBSERVATIONS VERSUS SOLAR FLARE ACTIVITY: AN EVENT COMPILATION
Robert M. Wilson Jan. 1977 86 p refs
(NASA-TM-X-73363) Avail: NTIS HC A05/MF A01 CSCL 03B

An event compilation is presented which correlates ATM/S-056 X-ray event analyzer solar observations with solar flare activity. Approximately 1,070 h of pulse height analyzed X-ray proportional counter data were obtained with the X-ray

event analyzer during Skylab. During its operation, 449 flares (including 343 flare peaks) were observed. Seventy events of peak X-ray emission > or = CI were simultaneously observed by ground based telescopes, SOLRAD 9 and/or Vela, and the X-ray event analyzer. These events were observed from preflare through flare rise to peak and through flare decline. Author

N77-17989*# State Univ. of New York, Albany. Space Astronomy Lab.
SKYLAB EXPERIMENT SO73: GEGENSCHEIN/ZODIACAL LIGHT Final Report, Oct. 1973 - Jan. 1976
J. L. Weinberg Aug. 1976 155 p refs
(Contract NAS8-30251)
(NASA-CR-150186) Avail: NTIS HC A08/MF A01 CSCL 03B

A 10 color photoelectric polarimeter was used to measure the surface brightness and polarization associated with zodiacal light, background starlight, and spacecraft corona during each of the Skylab missions. Fixed position and sky scanning observations were obtained during Skylab missions SL-2 and SL-3 at 10 wavelenghts between 4000A and 8200A. Initial results from the fixed-position data are presented on the spacecraft corona and on the polarized brightness of the zodiacal light. Included among the fixed position regions that were observed are the north celestial pole, south ecliptic pole, two regions near the north galactic pole, and 90 deg from the sun in the ecliptic. The polarized brightness of the zodiacal light was found to have the color of the sun at each of these positions. Because previous observations found the total brightness to have the color of the sun from the near ultraviolet out to 2.4 micrometers, the degree of polarization of the zodiacal light is independent of wavelength from 4000A to 8200A. Author

N77-17990*# Aerospace Corp., El Segundo, Calif. Lab. Operations.
MODULATION OF TRAPPED ENERGETIC ELECTRONS AT 6.6 Re BY THE DIRECTION OF THE INTERPLANETARY MAGNETIC FIELD Interim Report
George A. Paulikas and J. Bernard Blake 10 Aug. 1976 18 p refs
(Contract NASw-2879; F04701-75-C-0076)
(NASA-CR-149653; AD-A028999; TR-0076(6260-20)-13; SAMSO-TR-76-190) Avail: NTIS HC A02/MF A01 CSCL 20/8

Energetic (E sub e = 1.6 MeV = 3.9 MeV) trapped electron fluxes observed at the synchronous altitude during 1974 and 1975 by an experiment aboard ATS-6 exhibit a modulation in intensity which is correlated with the passage of sector structure boundaries of the interplanetary magnetic field past the earth. The electron fluxes reach equilibrium intensities during the time the magnetosphere is in a given IMF sector which are highest in the fall for (+) sectors and highest in the spring for (-) sectors. Author (GRA)

N77-17991# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
PREDICTION OF SOLAR ENERGETIC PARTICLE EVENT HISTORIES USING REAL-TIME PARTICLE AND SOLAR WIND MEASUREMENTS
E. C. Roelof and R. E. Gold Hanscom AFB, Mass. AFGL 25 Jun. 1976 22 p refs
(Contract N00017-72-C-4401; AF Proj. 6813)
(AD-A028057; AFGL-TR-76-0136; SR-1) Avail: NTIS HC A02/MF A01 CSCL 03/2

The comparatively well-ordered magnetic structure in the solar corona during the decline of Solar Cycle 20 has revealed a characteristic dependence of solar energetic particle injection upon heliographic longitude. When analyzing convection from the corona to the Earth, particle fluxes display an approximately exponential dependence on heliographic longitude. Since variations in the solar wind velocity and hence the coronal connection longitude can severely distort the simple coronal injection profile, the use of real-time solar wind velocity measurements can be of great aid in predicting the decay of solar particle events. Although such exponential injection profiles are commonplace during 1973-1975, they have also been identified earlier in Solar Cycle 20 (e.g., 1967 and 1969), and hence this structure may be present during the rise and maximum of the cycle, but somewhat obscured by greater temporal variations in particle injection. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-17992*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Dept. of Chemistry.
THE O(3P) AND N(4S) DENSITY MEASUREMENT AT 225 km BY ULTRAVIOLET ABSORPTION AND FLUORESCENCE IN THE APOLLO-SOYUZ TEST PROJECT Final Report
Frederick Kaufman (Pittsburgh Univ.), W. T. Rawling (Pittsburgh Univ.), T. M. Donahue (Mich. Univ., Ann Arbor), J. G. Anderson (Mich Univ., Ann Arbor), and R. D. Hudson 1976 17 p refs
(Contract NAS9-13803)
(NASA-TM-X-74340; MA-059) Avail: NTIS HC A02/MF A01 CSCL 03B

The densities of O(3P) and N(4S) at 225 km were determined during the Apollo Soyuz Test Project by a resonance absorption/fluorescence technique in which OI and NI line radiation produced and collimated on board the Apollo was reflected from the Soyuz back to the Apollo for spectral analysis. The two spacecraft maneuvered so that a range of observation angles of plus or minus 15 deg with respect to the normal to the orbital velocity vector was scanned. The measurements were made at night on two consecutive orbits at spacecraft separations of 150 and 500 m. The resulting relative counting rates as function of observation angle were compared to calculated values to determine the oxygen value. This value agrees with mass spectrometric measurements made under similar conditions. The nitrogen value is in good agreement with other measurements and suggests a smaller diurnal variation than is predicted by present models. Author

N77-17993*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A LONG-LIVED CORONAL X-RAY ARCADE
J. P. McGuire, E. Tandberg-Hanssen, K. R. Krall (NOAA), S. T. Wu (NOAA), J. B. Smith, Jr. (Ala. Univ., Huntsville), and D. M. Speich (Ala. Univ., Huntsville) Jan. 1977 24 p refs Sponsored in part by NOAA
(Contract NAS8-28097)
(NASA-TM-X-73362) Avail: NTIS HC A02/MF A01 CSCL 03B

A large, long-lived, soft X-ray emitting arch system observed during a Skylab mission is analyzed. The supposition is that these arches owe their stability to the stable coronal magnetic-field configuration. A global constant alpha force-free magnetic field analysis, is used to describe the arches which stayed in the same approximate position for several solar rotations. A marked resemblance is noted between the theoretical magnetic field configuration and the observed X-ray emmitting feature. Author

N77-17994# Air Force Geophysics Lab., Hanscom AFB, Mass.
SUMMARY OF CUTOFF RIGIDITIES CALCULATED WITH THE INTERNATIONAL GEOMAGNETIC REFERENCE FIELD FOR VARIOUS EPOCHS
M. A. Shea 26 May 1976 93 p refs
(AF Proj. 8600)
(AD-A028978; AFGL-TR-76-0115; AFGL-ERP-561) Avail: NTIS HC A05/MF A01 CSCL 08/14

Tables of cosmic-ray cutoff rigidities using the trajectory-tracing technique are given for five Epochs of the geomagnetic field. These values have been determined utilizing the International Geomagnetic Reference Field with time derivatives applied so that the coefficients for the field model are appropriate for the following Epochs: 1955.0, 1965.0, 1966.5, 1970.0, and 1975.0. Each table includes the geographic coordinates and L value of each location together with the main cutoff rigidity, the Stormer

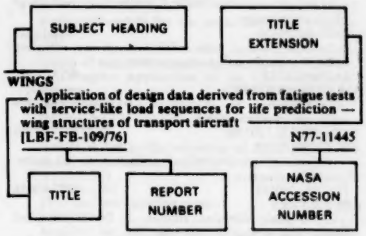
cutoff rigidity, and the effective cutoff rigidity. Tables for both vertical and non-vertical directions are included, as well as a listing of the FORTRAN computer program used to calculate these values. Author (GRA)

99 GENERAL

No abstracts in this category.

SUBJECT INDEX

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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Transfer of training effectiveness: A7E Night Carrier Landing Trainer [NCLT], device 2F103
[AD-A028836] N77-17115

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[NUP-A-76-5] N77-17845

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Effects of high G on pilot muscle strength available for aircraft control operation
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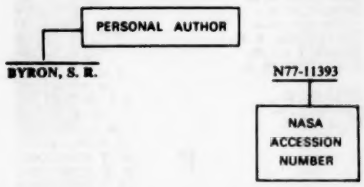

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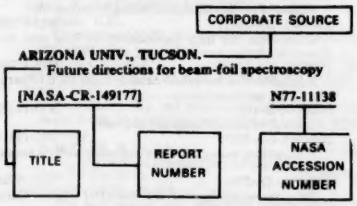

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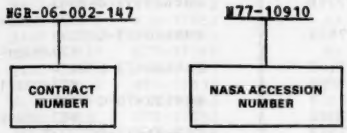

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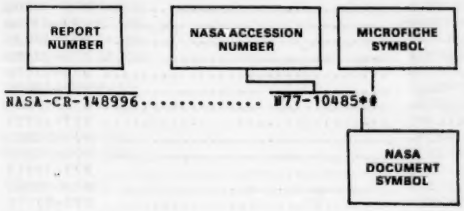

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